

Feb. 28, 1975

**HSL No.**  
**FEBRUARY 28, 1975**  
**THIS ISSUE CONTAINS:**  
HS-015 280-297; 299; 302;  
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U.S. Department of  
Transportation  
National Highway  
Traffic Safety  
Administration



*Shelve in Stacks S.B.T.*

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**SAE:** Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. Order by title and SAE report number.

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## **Abstract Citations**

HS 015 326

## THE VEHICLE COLLISION ENVIRONMENT

Accident data, vehicle collision dynamics, and corresponding occupant dynamics are examined. Consideration is given to: occurrence rates of accident types; computerized reconstruction calculations for accident investigations; barrier impact tests and trajectories; anthropometric dummies; design goals for structures and restraint systems; frontal crush properties; side impacts; rollover protection; rear collision protection; and mathematical models.

by R. R. McHENRY

Cornell Aeronautical Lab., Inc., Buffalo, N. Y. Transp. Res. Dept.

1973 ; 17p 35refs

Based upon research conducted for the National Highway Traf. Safety Adm., published in BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN, SAE (P-49). Availability: Corporate author; SAE

HS-015 280

## ANALYSIS OF NITRIC OXIDE FORMATION IN SPARK IGNITION ENGINE WITH HEAT TRANSFER AND EFFECT OF IGNITION POINT

The formation of nitric oxide in the combustion chamber of a spark ignition engine is formulated by developing a simple model. The state of the gas in the chamber and its thermal properties are estimated during a complete cycle. The estimation of the nitric oxide formation is based on the Zeldovich mechanism and assumes the burned gas either in a fully mixed or unmixed state. A simple heat transfer relation is used to estimate the heat loss from the gas to the chamber walls. The effect of the position of the ignition source relative to the exhaust port is also taken into account, and the predicted nitric oxide concentrations are compared with experimental results from a single-cylinder variable compression ratio IFP engine. It is found that the nitric oxide concentration predicted by the model agree well over the operating range with the experimentally measured nitric oxide concentrations in the exhaust gas. The effect of the location of the flame initiation point with respect to the exhaust port is noteworthy. When the flames is initiated nearer the exhaust valve, the nitric oxide concentration is higher in the exhaust when the flame is initiated at a point farther from the exhaust valve.

by G. G Lucas; K. Varde

Loughborough Univ. of Technology, Leics. (England)

Rept. No. SAE-740189 ; 1974 ; 14p 22refs

Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.

Availability: SAE

HS-015 281

## EXPERIMENTAL AND THEORETICAL INVESTIGATION OF TURBULENT BURNING MODEL FOR INTERNAL COMBUSTION ENGINES

A model for describing turbulent flame propagation in internal combustion engines is presented. The model is based on the assumption that eddies having a characteristic radius are en-

trained by the flame front at a turbulent entrainment velocity and subsequently burn in a characteristic time, where the laminar flame speed for the fuel-air mixture is a factor. An approximate analytic method for determining the equilibrium state of the burned gases is also presented. To verify the predictions of the model, experiments were carried out in a single-cylinder research engine at speeds from 1000-3200 rpm, spark advances from 30-110 deg btc and fuel-air equivalence ratios from 0.7-1.5. Simultaneous measurements of the cylinder pressure and the position of the flame front as a function of crank angle were made, and good agreement with the predictions of the model was obtained for all operating conditions. Correlations were calculated from a knowledge of the engine geometry, fuel type, and operating conditions. It is anticipated that the model will be useful for design studies directed toward improving the efficiency and pollution characteristics of internal combustion engines.

by N. C. Blizard; J. C. Keck

Massachusetts Inst. of Tech. Cambridge. Dept. of Mechanical Engineering

Rept. No. SAE-740191 ; 1974 ; 19p 31refs

Presented at the Automotive Engineering Congress, Detroit 25 Feb-1 Mar 1974. Supported by the Ford Motor Co. and General Motors Corp.

Availability: SAE

HS-015 282

## CHEMI-IONIZATION AND CARBON IN A SPARK IGNITION ENGINE

The role of the chemi-ionization region in producing ions that may be efficient centers for the nucleation of the carbon particles is studied. It is noted that carbonaceous materials associated with potent carcinogens such as 3-4 ben(a)pyrene (baP) and carcinogenes other polynuclear aromatic (PNA) hydrocarbons constitutes the greatest part of the particulate found in the exhaust gases of an internal combustion engine. The probable precursors of carbon particles are radicals formed in the incomplete combustion zone while their nucleation is made possible by ions originating in the flame. Ion current instantaneous values were measured by means of modified Langmuir's probe, thus calculating thickness and speed of the flame in an engine cylinder. Relations between ion current and collected soot weight were examined. Fuel quality and additive influences over carbon and PNA formation were obtained.

by V. Arrigoni; G. M. Cornetti; G. P. Gerbaz; F. Giavazzi; U. Pozzi

SNAM Progetti, Milan (Italy)

Rept. No. SAE-740192 ; 1974 ; 18p 26refs

Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974. Prepared for AGIP.

Availability: SAE

HS-015 283

## SIMULATION AND OPTIMIZATION OF THERMODYNAMIC PROCESSES OF DIESEL ENGINE

A mathematical model of an open-chamber diesel engine was programmed for solution on a digital computer. The program

incorporates an automatic procedure which, given the limits of design variables, will predict the values of these variables that will optimize engine performance. This technique can provide these results in a fraction of time taken by parametric methods and provides a quick and efficient tool that can be used directly by the designer or the development engineer. Examples are given to maximize engine power to torque.

by H. D. Shroff; D. Hodgetts  
Cranfield Inst. of Tech., Beds. (England)  
Rept. No. SAE-740194 ; 1974 ; 20p 8refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 284

#### **ANALYTICAL INVESTIGATION OF THE PERFORMANCE OF CATALYTIC MONOLITHS OF VARYING CHANNEL GEOMETRIES BASED ON MASS TRANSFER CONTROLLING CONDITIONS**

A new criterion is presented for comparing the performance of catalytic monoliths of various channel geometries and a better geometry for analyzing channels of wave-like pattern. Under mass transfer rate controlling conditions, the performances of ducts of different geometry is analyzed and compared on the basis of equivalent duct open area. Results indicate that the monolith length required for a 99% carbon monoxide conversion is in the following ascending order: conduits of rectangular cross section, wave ducts, equilateral triangles, squares, circles and hexagons.

by W. C. Johnson; J. C. Chang  
Minnesota Mining and Mfg. Co., St. Paul  
Rept. No. SAE-740196 ; 1974 ; 26p 7refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 285

#### **LOW EXPANSION CERAMIC MATERIAL FOR CATALYSIS SUPPORTS**

The characteristics of cordierite type compositions and the relationship between thermal expansion and raw materials, processing, and gross composition are examined. Other possible support materials are reviewed briefly. These include mullite, zircon, beryl, spodumene, aluminum titanate, silicon nitride, and other low expansion compositions. Raw material cost, processing, and reactivity with the catalysis are discussed for these materials.

by J. L. Pentecost; J. K. Cochran  
Georgia Inst. of Tech., Atlanta  
Rept. No. SAE-740198 ; 1974 ; 6p 11refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 286

#### **HIGH TEMPERATURE SEALS, AUTOMOTIVE AND OTHER VEHICLES**

The general limits normally associated with polymer types of seals are discussed along with indications of progress in upgrading certain materials. The interdependence of sealing design relationships such as design performance and reliability are presented in an organized format that is designed to help overall evaluation. A few statements are included to help summarize the status of International Standardization of Sealing Devices with regard to the implications of the United States' adoption of the metric system and its effect on world trade.

by L. G. Hiltner  
Parker Seal Co., Culver City, Calif.  
Rept. No. SAE-740199 ; 1974 ; 5p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 287

#### **A STUDY OF THE RELATION BETWEEN USED TEMPERATURE AND SEALING CHARACTERISTICS ON OIL SEALS**

The relation between temperature and the sealing characteristics of oil seals is examined. It is clear that the condition of the rubbing surface is closely related to the sealing characteristics of oil seals, and that the lower the ambient temperature falls, the rougher their rubbing surfaces become. The roughening condition of the rubbing surface is intimately related with the environmental temperature, the rubbing period, the lubricating condition, the lip design, and the compounds.

by H. Hirabayashi; H. Chikamori; Y. Mikami; A. Matsushima  
Nippon Oil Seal Industry Co. Ltd., Fujisawa (Japan); NOK-USA, Inc., Santa Ana, Calif.  
Rept. No. SAE-740200 ; 1974 ; 7p 7refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 288

#### **TRIANGULAR ASPERITIES CONTROL SEAL LEAKAGE AND LUBRICATION**

Arrays of triangular asperities have been developed for surface treatment of rigid sealing members of either radial lip or face sealing systems. The arrays consists of multiplicities of closely spaced triangular asperities and can be varied in geometry to control the flow of lubricant within the lubricant film which separates the sealing members. The asperities are oriented so that the base of each triangle is parallel to the direction of seal travel. Lubricant flow is directed toward the apex of each triangular asperity. Asperities can be modified in shape to increase the fluid film thickness. This technique provides control of seal leakage, temperatures, and wear, the primary factors affecting seal performance.

by D. L. Otto  
Timken Co., Canton, Ohio  
Rept. No. SAE-740201 ; 1974 ; 9p 8refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974. Prepared in cooperation with Batelle Memorial Inst., Columbus, Ohio.  
Availability: SAE

HS-015 289

**RUBBER AND LUBRICANT COMPATIBILITY**

Some of the rubber-lubricant compatibility problems facing the rubber compounder, the oil seal designer, the seal user, and the lubricant supplier as the result of anticipated higher operating temperatures are discussed. Lubricants are specified primarily with gears, bearings, or total system performance in mind, frequently with little consideration being given to their effect on seals. Rear axle lubricants are reviewed in some detail along with their effects on various rubber compounds at elevated temperatures. Automatic transmission fluids and engine oil are also considered. The solution to the high temperature seal problem should be found not only in better seal compounds but also in better high temperature lubricants which are less severe in their effect on rubber.

by A. S. Berens  
Federal-Mogul Corp., Detroit, Mich.  
Rept. No. SAE-740203 ; 1974 ; 7p 4refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 290

**SPRING POSITION MEASUREMENT: A REVIEW OF CURRENT TECHNIQUES AND A PROPOSED NONDESTRUCTIVE MEASUREMENT TECHNIQUE**

The current terminology, techniques, and definition of spring position measurement, an important radial lip seal parameter, are reviewed. The controversy of the subject is resolved by standardizing the terminology, redefining the parameter, and proposing a nondestructive measurement technique. The proposed measurement technique can be of value to radial lip seal users as well as suppliers. It is shown that the most significant axial relationship between the centerline of the spring and the primary lip contact surface of a radial lip seal exists with the seal in its operating attitude.

by S. N. Smith  
Federal-Mogul Corp., Detroit, Mich.  
Rept. No. SAE-740204 ; 1974 ; 8p 5refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 291

**SHAFT LEAD MEASUREMENT--A NEW TECHNIQUE**

A highly magnified picture of the surface of a shaft generated by running the profile signal from a stylus scanner into an X-Y recorder is described. Successive traces across a surface area can be put together much the same as is the picture from a scanning microscope. A permanent record is made in which not only the lead of a shaft is identifiable, but also the surface condition including pits, flaws, burrs, and cracks.

by J. A. Bentley  
Federal-Mogul Corp., Detroit, Mich.  
Rept. No. SAE-740205 ; 1974 ; 5p 2refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 292

**TOYOTA ESV ENERGY MANAGEMENT SYSTEM AND WEIGHT ANALYSIS OF A SAFETY VEHICLE**

The basic elements of the Toyota Experimental Safety Vehicle (ESV) energy management system is described, consisting of silicone rubber-type front bumper shock absorbers, an efficient energy-absorbing frame, and upper members for preventing vehicle pitch during impact. The Toyota ESV proved to have satisfactory performance in an 80 km/h frontal impact against flat and pole barriers by adequately balancing the strengths of these elements and effectively arranging the energy-absorbing members of the frame. Based on experiences with ESV tests, the relationship between crashworthiness variations and vehicle weight or size were studied in detail.

by A. Wada; H. Watanabe; M. Nakamura  
Toyota Motor Co. Ltd., Kariya (Japan)  
Rept. No. SAE-740206 ; 1974 ; 15p 3refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974  
Availability: SAE

HS-015 293

**EXPERIMENTAL SAFETY VEHICLES IN THE 1500 LBS., 2000 LBS., AND 2500 LBS., WEIGHT CLASSES--BODY DESIGN AND CRASHWORTHINESS**

Results from development and test work on the crashworthiness of three European Experimental Safety Vehicles (ESVs) in the 1500, 2000, and 2500 lb classes of current production cars are described and illustrated. The diversity of weight, mechanical layout, and body features of the three types of cars, each type considered in the standard reinforced, and ESV versions, has allowed a detailed survey of the more significant problems that may arise in improving crashworthiness. Emphasis is placed on the effect of the high specification requirements for the 4000 lbs., ESV in relation to the weight and cost of these car classes.

by G. PULEO  
Fiat S. P. A., Turin (Italy)  
Rept. No. SAE-740207 ; 1974 ; 22p 2refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 294

**ON CRASHWORTHINESS OF NISSAN ESV**

The Nissan Experimental Safety Vehicle (ESV), with lightweight monocoque construction, is described. The problem of crashworthiness in frontal collisions is examined in terms of basic analyses and test results in the development process, and of body construction and test results of the two Nissan ESV types. The analyses and experiments have clarified: the rate of energy absorbed by each unit; the energy absorbing characteristic of each unit of body component member; the magnitude of a force acting on each unit of the

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passenger compartment; and the advantages and problems involved in using high-tensile steel and aluminum.

by K. Mitsuhashi; H. Shimoe; N. Aya; M. Tsutamoto  
Nissan Motor Co. Ltd., Yokohama (Japan)  
Rept. No. SAE-740208 ; 1974 ; 17p 10refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 295

### EFFECT OF GROUND ON NEAR-HORIZONTAL SOUND PROPAGATION

The propagation of sound from a small source over the ground, considered as an impedance boundary, is discussed theoretically and compared with measurements over short grass and asphalt. Interference phenomena relevant to the measurements configurations in SAE procedures for testing vehicles are emphasized. The effect of the ground impedance on propagation at the longer distances relevant to airport and highway design is also discussed.

by J. E. Piercy; T. F. W. Embleton  
National Res. Council of Canada, Ottawa, Ont.  
Rept. No. SAE-740211 ; 1974 ; 10p 12refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 296

### PROGRESS IN DIESEL ODOR RESEARCH

General considerations of odor research, diesel combustion, and combustion product analysis are presented in a review of research progress. After three years of concentrated effort involving the development of new odor measurements, sampling, and diesel exhaust analysis and preparation techniques, odorants comprising the two major diesel odor characteristics were identified. Compounds which are also components of diesel fuel were shown to contribute to one odor characteristic. Oxydized derivatives, generally of the same classes of compounds as those shown to contribute to the first odor characteristic were tentatively identified by structure to comprise the second major odor characteristics. The recent work has resulted in the development of a laboratory prototype instrument for determining diesel odor. Although research has been hindered by the requirement of subjective odor measurements, the limitation of analytical techniques, and the limited understanding of the diesel combustion process, significant progress has been made in diesel odor research which has already led to the reduction of diesel odor emissions.

by C. W. Savery; R. A. Matula; T. Asmus  
Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics; Chrysler Corp., Detroit, Mich.  
Grant ORG/NAPCA-AP-00576-04  
Rept. No. SAE-740213 ; 1974 ; 13p 41refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 297

### PUBLIC OPINION OF DIESEL ODOR

The results of a public opinion survey on testing of diesel exhaust odors conducted during 1969 and 1970 are described. Major goals of the research were to relate public opinion of the odors and the objectionability associated with them to odor intensity, and to obtain a dose-response curve as the primary result. The dose-response curve was needed to assess odor-control technology by providing a criterion for deciding whether the effect of a given control item would be noticed by the general public, reduce complaints, or be worth the cost and effort required for its implementation. The engine used as the live odor source was a two-stroke cycle type similar to those used in many buses. It was found that a relationship existed between perceived diesel exhaust odor intensity and the objectionability of these odors. The nature of this relationship was that increasingly intense diesel exhaust odors were considered increasingly objectionable. The data also show that a substantial reduction in diesel exhaust odor intensity would be required to cause a worthwhile reduction in the objectionability of these odors.

by C. T. Hare; K. J. Springer; J. H. Somers; T. A. Huls  
Southwest Res. Inst., San Antonio, Tex.; Environmental Protection Agency, Washington, D. C.  
CONTRACT PH-22-68-36; CPA-70-44  
Rept. No. SAE-740214 ; 1974 ; 23p 15refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 299

### MOTORCYCLE ACCIDENTS: WHO, WHEN, WHERE, AND WHY

The conditions which prevail when motorcycle accidents occur are characterized. All single vehicle motorcycle accidents (N0706) and all car-motorcycle accidents (N01418) which occurred in North Carolina in 1972 were investigated. Tabular presentations provide comparison between motorcycle accidents and similar passenger car accidents. It is shown, that when cars and motorcycles collide, the cyclist nearly always sustains a more severe injury than the motorist. It is also noted that the motorcycles small size and distribution in traffic cause visibility or perception problems for other drivers. Protective clothing and educational countermeasures are mentioned, along with vehicle design for injury prevention.

by L. I. Griffin, 3rd.  
North Carolina Univ., Chapel Hill. Highway Safety Research Center  
1974 ; 51p  
Supported in part by the North Carolina Governor's Hwy. Safety Prog.  
Availability: Corporate author

HS-015 302

### COMMUNITY PARTICIPATION IN HIGHWAY PLANNING

The importance of involving the community and citizens in creative planning for transportation quality is studied. Recommendations are offered for legislation which will require an expanded program of citizen participation in highway planning;

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establishment of an operating program to support effective citizen and community participation; establishment of an adequate education and training program in the principles, techniques and skills of community-citizen participation methods throughout the national highway program; and establishment of an adequate program of research within the Federal Highway Administration in the field of community relations and citizen involvement in highway and transportation planning. A discussion of questions and issues related to community participation is included.

Department of Transp., Washington, D.C. Citizen's Advisory Com. on Transp. Quality  
1972 ; 64p 35refs

Prepared for the Secretary of Transp.  
Availability: U. S. Department of Transportation, Office of Consumer Affairs, Washington, D. C.

HS-015 304

### **THE INTERNATIONAL SYSTEM OF UNITS. CONVERSION FACTORS & TABLE EQUIVALENTS**

In an effort toward promulgating the International System of Units (SI) and to substitute the new NEW SI Units for the U. S. Standard Units of Measurements, conversion tables have been developed for values that are believed to be most widely used in the highway and bridge engineering fields. Conversion of other values not included in the tables could be arrived at either by interpolation, or by use of the conversion formula appearing at the top of each table. It is recommended that all persons involved in engineering familiarize themselves with the new system since its national adoption seems probable.

by J. A. Gibeily  
Federal Hwy. Administration, Washington, D. C.  
1973 ; 36p  
Availability: Corporate Author

HS-015 305

### **HIGHWAY ACCIDENT REPORT, GREYHOUND BUS/MALONE FREIGHT LINES, INC. TRUCK COLLISION--U. S. ROUTE 11W--BEAN STATION, TENNESSEE, MAY 13, 1972**

A major accident on an interstate highway between an intercity bus and a tractor-semitrailer which collided nearly head-on is described. The tractor and the trailer cargo were destroyed in a post-impact fire which involved only the tractor-semitrailer. Both drivers and 12 bus passengers were killed; 14 injured. The cause of accident was determined to be the driving of the bus in the opposing lane of traffic while the bus was passing an automobile without unobstructed clear-sight distance ahead, and the bus driver's failure to avoid the tractor-semitrailer for unknown reasons. Factors which contributed to the collision and to the injuries and fatalities are cited. Recommendations are offered to the Bureau of Motor Carrier Safety and National Highway Traffic Administration concerning seat restraints for bus passengers and impact protection for interior panels around bus windows.

National Transportation Safety Board, Washington, D. C.  
Rept. No. NTSB-HAR-73-5 ; 1974 ; 41p refs  
Report contains Highway Safety Recommendations H-73-41 through H-73-43. Adopted 25 Oct. 1973.  
Availability: NTIS

HS-015 306

### **FTC MONITOR. A NEW TRAFFIC SAFETY DEVICE**

A new highway safety device called FTC Monitor which is described is designed to reduce accidents caused by tailgating or following too closely. It is an electronic logic system that precisely measures the time lapse between vehicles and signals if it is improper. The invention includes a detector in the highway that locates the front and rear of every automobile passing in its lane of travel, a logic system that throws a signal to a sign on the highway or to a police car, and a sign that flashes a "danger" signal to the following motorist if he is travelling dangerously close. There is an additional signal noting "violation" if he is flagrantly following too close. A camera is included which automatically takes picture of the violator. Field tests and proposed future tests are described.

Marshall (Arthur) and Co., Richmond, Va.  
1970 ; 19p  
Availability: Reference copy only

HS-015 312

### **THE OPERATIONAL MEANING OF REPORTED ALCOHOL INVOLVEMENT IN OFFICIAL STATE ACCIDENT DATA: A COMPARATIVE ANALYSIS**

The impact of the lower legal drinking age on the alcohol-related highway crash experience of affected young driving populations in Maine, Michigan, and Vermont is examined. Operational formats and meanings of reported alcohol involvement are detailed. It is shown that reported alcohol involvement was often confounded with legal violations, physical impairments and handicaps, or driver negligence. Discrimination between multiple contributing circumstances, including drinking, was often determined to be impossible because of the ways in which accident data are coded. A comparative analysis shows that plausible rival hypotheses in the forms of selection and instrumentation were inherent in the operational definitions of the official crash data.

by R. L. Douglass  
Publ: HIT Lab Reports v4 n9 pl-6 (May 1974)  
1974 ; 1ref  
Availability: See publication

HS-015 313

### **EMPIRICAL DEVELOPMENT OF A SURROGATE MEASURE OF ALCOHOL INVOLVEMENT IN OFFICIAL ACCIDENT DATA**

The empirical development of a surrogate measure of alcohol involvement is described which has been found to be applicable to both young and old drivers with equal reliability over time and between eleven jurisdictions in the quasi-experimental design. The validity of the empirical surrogate is discussed on the basis of several independent studies of the role of alcohol in accident causations. A computer algorithm known as AID (Automatic Interaction Detector) was used to determine sets of independent variables from accident investigation forms which interactively provide the best predictions of alcohol involvement. Three factors were identified that consistently enter into prediction models for alcohol-related crashes: time of crash, sex of driver, and number of moving vehicles. Using these three factors and subsetting total crash

populations to isolate crashes which occurred between 9:00 p.m. and 6:00 a.m., with male drivers involving a single moving vehicle, the proportion of alcohol involvement is consistently about 53-65%, between jurisdictions and age groups.

by R. L. Douglass; L. D. Filkins  
 Publ: HIT LAB REPORTS v4 n9 p7-11 (May 1974)  
 1974 ; 7ref  
 Availability: See publication

## HS-015 314

### AGE, EXPOSURE, AND ALCOHOL INVOLVEMENT IN NIGHT CRASHES

Driving and crash patterns of young drivers age 16-25, are compared. The use of random samples of the driving population is presented as an alternative exposure measurement technique. The high occurrence of young drivers in night, single-vehicle crashes was found to be related to exposure with two exceptions: drivers aged 16 to 18 are overinvolved in nonalcohol-related crashes and drivers aged 18 to 21 are overinvolved in alcohol-related crashes. These overinvolvements are consistent with the assumption of a learning-to-drive and a learning-to-drink-and-drive model of crash occurrence. Once these learning periods have passed, the high percentage of crash involvement of drivers aged 19 to 25 corresponded to high driving exposure. The use of relative exposure is presented as a useful device for determining overinvolvement in crashes.

by W. L. Carlson  
 Publ: Journal of Safety Research v5 n4 p247-59 (Dec 1973)  
 1973 ; 15refs  
 Availability: See publication

## HS-015 315

### AGENDA FOR THE SUBCOMMITTEE ON SCOPE, JURISDICTION AND ENFORCEMENT

An agenda is presented which includes proposed revisions to the Uniform Vehicle Code received prior to April 1, 1974. They include: definitions of conviction, motor-driven cycle and minibike, multipurpose passenger vehicle, revocation, special mobile equipment, vehicle; licensing mechanics; rejection of uninsured motorists' coverage; no fault reparations; differences between the Uniform Vehicle Code and the Uniform Motor Vehicle Accident Reparations Act; unsatisfied claim and judgment funds; pre-arrest breath test; chemical tests of urine; implied consent; chemical tests in fatal crashes; special plates for cars owned by convicted drunk drivers; the Vehicle Equipment Safety Compact; equipment; authority to arrest without warrant; impounding vehicles of scofflaws; disposition of fines; jail sentences; traffic law violation de-criminalization; law evaluation; and law suspension to permit experimentation.

National Committee on Uniform Traffic Laws and Ordinances, Washington, D. C.  
 1974 ; 48p  
 Availability: Corporate author

## HS-015 316

### AGENDA FOR THE SUBCOMMITTEE ON VEHICLES

An agenda is presented which includes proposed revisions to the Uniform Vehicle Code received prior to May 31, 1974. They include: equipment approval; DOT terminology; federal standards for new vehicles; yellow lights; two tail lights; small trailers; slow-moving vehicle emblem; auxiliary lamps and their height; emergency vehicle lights; rotating lights; blue-red lights on police vehicles; head lamp types; multiple-beam headlights; reflective material; back-up lights; brakes on towed motor vehicles; surge brakes; audible backing and turn signals; mirrors; hazardous materials signs; passive restraints; air bags and seat belts; seat belts in trucks and buses; mandatory use of seat belts; speedometers; odometers; windshield or goggles; spray protectors; traffic light controllers; width of vehicles and towed vehicles.

National Committee on Uniform Traffic Laws and Ordinances, Washington, D. C.  
 1974 ; 102p  
 Availability: Corporate Authors

## HS-015 317

### THE JOURNEY TO DEATH: A SPATIAL ANALYSIS OF FATAL TRAFFIC CRASHES IN MICHIGAN, 1969

A spatial analysis of fatal traffic crashes in Michigan in 1969 is presented. The analysis combines concepts from geographical, epidemiologic, and statistical theory, and focuses those concepts on the phenomenon of fatal traffic crashes. The analysis is conducted under the rubric of movement in space as it pertains to the fatality. Two geographic models are devised, at the micro and macro scales. The micromodel is inductive and operates at the level of the individual, utilizing the residence-to-crash site distance as the dependent variable and sets of geographical and demographic variables as independent variables while controlling for temporal effects. The work is conducted on three subsets of those killed in traffic crashes, drivers, pedestrians, and bicyclists, and motorcyclists. With drivers the geographical variables dominated the demographic almost to their exclusion, while for pedestrians and bicyclists the geographic variables still dominated, although the demographic variables were also important. The macromodel is deductive and operates at the scale of the county, utilizing the concepts of spatial movement devised from geographical theory, namely the Warntz potential model. It estimates population potential which is analogous to a spatial population of risk for traffic crashes, quantities not possible to estimate with other methods. The explanation of the macromodel is highest for drivers and lowest for motorcyclists.

by H. Moellering  
 Michigan Univ., Ann Arbor  
 Rept. No. MG-PUB-13 ; 1974 ; 198p 155refs  
 Availability: Michigan Univ., Department of Geography, Ann Arbor

## HS-015 318

### TECHNIQUES FOR ESTABLISHING TOLERANCES TO IMPACT

Techniques developed to study, calculate, and estimate human tolerance levels are discussed. Tests to determine human voluntary subjective limits have been restricted primarily to



young healthy male military volunteers. Exploration of either injury-threshold levels of tolerance or survival limits have utilized clinical correlations, fresh or embalmed cadavers, anesthetized animals, accidental free-falls, damage sensitivity curves and injury scales, anthropomorphic dummies, and mathematical models. Each of these methods is contributing to knowledge about human tolerances.

by R. G. Snyder  
Michigan Univ., Ann Arbor  
1973 ; 19p 139refs  
Reprinted from BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN, SAE (P-49).  
Availability: Corporate Author; SAE

HS-015 319

## HEAD INJURY

Three head injury producing factors are identified which can be controlled somewhat by design. These are abrupt changes in translational and rotational movements of the head as well as deformation of the skull. Impact safety design based on linear acceleration concussion tolerance indices provides the best protection against these mechanisms because linear acceleration measurements include components of translation as well as centrifugal and tangential acceleration due to rotation. Design to reduce linear acceleration due to rotation will reduce skull deformations and relative movements in the head caused by any of the three factors. Since there are indications that concussion is a short duration impact phenomenon occurring only within the range of about 0.015 s, any protection system which prevents a critical concussion index within this time will usually prevent any form of internal head injury.

by V. R. Hodgson  
Wayne State Univ., Detroit, Mich. School of Medicine  
1973 ; 8p 44refs  
Reprinted from Biomechanics and its Application to Automotive Design, SAE (P-49).  
Availability: Corporate Author; SAE

HS-015 320

## FACIAL INJURY

Automobile design is examined in terms of its relationship to facial injury prevention. Research methods and physical properties of facial bones, tissue, and skin are reviewed. The effectiveness of seat belts in reducing injury is noted, along with changes in the design of the windshield and instrument panel. Five major categories of injury from facial and head impact with the instrument panel are outlined: contusions, lacerations, facial bone fractures, skull fracture, and brain damage. Suggestions are offered for an improved laminated tempered glass and plastic windshield.

Publ: BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN, SAE (P-49).  
1973 ; 12p  
Availability: SAE

HS-015 321

## NECK INJURY

A simplified description of the anatomy of the neck is presented. Injury mechanisms which can result from severe

hypertension or hyperflexion of the neck are discussed, as well as a method of analysis which has been used to determine the neck's strength in resisting these motions. Methods of mitigating these types of neck injuries through restraint system design and evaluation are described. It is noted that, in order to evaluate the performance of a restraint system in terms of mitigation of neck injury, dummies with humanlike neck responses must be used. The current commercial dummies are deemed inadequate for this type of evaluation because they lack humanlike neck response.

by H. J. Mertz  
General Motors Res. Labs., Warren, Mich.  
1973 ; 29p 17refs  
Reprinted from BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN, SAE (P-49).  
Availability: Corporate Author; SAE

HS-015 322

## CHEST TRAUMA

Thoracic injury research is reviewed, and the relationships between impact and injury are examined. The ideal feasible experiments to study them are cited as those involving animals, anthropometric configuration, computer simulations, and cadavers. Critical areas which need to be examined are the relationships between chest impact in the most common kinematic configurations, and the pathophysiologic changes which are commonly reported in studies of human injury patterns. Key points to study must include the structural characteristics of the thoracic cage and how deflection and/or failure in part or whole are related to superficial and deeper injuries of the thoracic area. Means must be devised to measure chest wall damage and deflection, intravascular pressure and displacement, and changes which can be associated with serious or fatal pathophysiologic alternations. Chest impact tolerance data from human experiments must be derived from the forces at the chest restraint interface. It is suggested that impact intensity, impact duration, and chest wall deflection are the most useful measurements for total anterior chest tolerance.

by A. M. Nahum  
California Univ., Los Angeles  
1973 ; 7p 16refs  
Reprinted from BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN, SAE (P-49).  
Availability: Corporate Author; SAE

HS-015 323

## BLUNT ABDOMINAL INJURIES: AN OVERVIEW

The more common lesions resulting from blunt abdominal trauma are discussed. The mechanisms influencing the development of specific injuries are difficult to measure accurately in the living subject. Certain patterns of injury are often grouped together and the clinician needs to be alerted to them. The force of the injury often will not parallel the degree of underlying visceral damage. No organ is immune from injury and

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when surgical exploration is performed, a thorough examination of all the peritoneal contents should be made.

by A. J. Walt; R. F. Wilson  
Wayne State Univ., Detroit, Mich. School of Medicine;  
Detroit General Hosp., Mich.

1973 ; 9p

Supported by the Detroit General Hosp. Res. Corp. Reprinted from **BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN**. SAE (P-49).

Availability: Corporate Author; SAE

HS-015 324

### **BIOMECHANICS OF THE SPINE AND PELVIS**

Existing knowledge on the impact biomechanics of the spine and pelvis is reviewed, revealing that more research is needed to completely understand injury mechanisms and tolerance levels. Research data are summarized for caudocephalad acceleration and forward deceleration. Further work is suggested on the mechanisms of pelvic fractures, particularly in the protection of pedestrians. It is noted that the dual load path through the vertebral bodies and the articular facets increases the difficulty in providing for its protection against caudocephalad acceleration. At each level, the spinal curvature and eccentricity of the load carried by the vertebra must be adjusted so that no excessive load is transmitted via either path.

by A. I. King  
Wayne State Univ., Detroit, Mich.

1973 ; 13p 45refs

Reprinted from **BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN**. SAE (p-49).

Availability: Corporate Author; SAE

HS-015 325

### **STRUCTURAL FAILURE OF LONG BONES**

Structural failure of long bones is examined in terms of functional analysis, ligamentous structure, and injuries which destroy the bone's loadbearing capability. It is shown that a relatively small amount of energy is required to cause catastrophic failure of a long bone. The complexity of damage to child and adolescent bones is described, in that damage along the epiphyseal line can result in deficiency of bone growth. Considerations of bone strength must involve the mode of loading as well as the rate of load application. Injuries resulting in damage to the joint surface are also discussed. The dangers of stating load tolerances for axial loading conditions for the human accident victim are concluded to arise from the extreme sensitivity of the fracture mode to the loading direction.

by A. H. Burstein  
Case Western Reserve Univ., Cleveland, Ohio

1973 ; 6p

Reprinted from **BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN**. SAE (p-49).

Availability: Corporate Author; SAE

HSL 75-2

HS-015 327

### **HUMAN TOLERANCE TO IMPACT AND ITS APPLICATION TO SAFETY DESIGN**

Crashworthiness is discussed as a matter of reducing the relative velocity between the occupant and the vehicle interior to zero during a collision without injuring him, with acceleration and human tolerance to impact injury being the key ingredients to automobile safety. Human predetermined degree of injury, and average individual responses, effects of impact are examined: relative velocity, impact site, area of contact, mass and geometry of the impactor, surface hardness and roughness, direction and duration of impact. Injury indexes are reviewed, along with Federal Motor Vehicle Safety Standards and injury criteria, aspects of vehicle and occupant dynamics, and safety design procedures and examples.

by L. M. Patrick  
Wayne State Univ., Detroit, Mich. Biomechanics Research Center

1973 ; 15p 7refs

Published in **BIOMECHANICS AND ITS APPLICATION TO AUTOMOTIVE DESIGN**, SAE (P-49).

Availability: Corporate author; SAE

HS-015 328

### **DIRECTIONAL MEDIAN CROSSOVERS**

The implementation of directional median crossovers on a divided highway is reviewed and their effects examined. Problems associated with early road crossovers included motorist confusion, which has been eliminated by improved signing, and capacity excesses at intersections with a high percentage of left turns, which have been reduced by back-to-back directional crossovers. It is shown that two-way signal progression is possible at all times of the day on sections of divided roadways with directional crossovers, resulting in great reduction of total vehicle delays, good platooning of vehicles, and improved traffic flow. It is suggested that drops in accident rates are at least partially due to directional crossovers in Michigan.

by W. F. Savage

Publ: Traffic Engineering v44 n11 p21-3 (Aug 1974)  
1974

Availability: See publication

HS-015 329

### **TWO-WAY, LEFT-TURN LANES WORK ×**

Total accidents are shown to be down after installation of two-way, left-turn lanes in studies of four Michigan locations. Before- and after-accident records compiled by the Department of State Highways and Transportation reveal that reductions in all types of accidents were down by 33%. Head-on collisions were also reduced, along with injuries from this type of accident. A limitation of the two-way left-turn lanes is noted to be traffic capacity limits, especially on street with commercial driveways directly across from each other. Service drives are recommended to reduce the number of drive opening on the highway and improve its operational characteristics.

by M. R. Hoffman

Publ: Traffic Engineering v44 n11 p24-7 (Aug 1974)  
1974

Availability: See publication

HS-015 330

# DESIGN ISSUES OF A LEGAL IMPACT STUDY: THE LOWER LEGAL DRINKING AGE AND YOUTH CRASH INVOLVEMENT

Lower legal drinking ages were studied to determine the effects on youth crash involvement in seven states. A surrogate measure dependent variable was developed consisting of late night, single-vehicle crash involvements with male drivers. A surrogate was determined to be necessary in that officially reported alcohol involvement statistics were found to be inconsistently measured over time and were incomparable between states. It was found that statistically and socially significant increases in alcohol-related crashes resulted in Michigan and Maine following the effective dates of the 18-year-old legal drinking ages. No concomitant changes were found in Vermont, or in any of the four control states. Analysis of age-specific alcohol-related crash frequency distributions provided support and explanation for the results of the time-series analyses, and provided a basis for prediction regarding the expected effect of the lower legal drinking age on youth crash involvement.

by R. L. Douglass; L. D. Filkins; J. D. Flora  
Publ: HIT Lab Reports v4 n10 p1-11 (Jun 1974)  
1974 0815refs

Article was adapted from "The Effect of Lower Legal Drinking Ages on Youth Crash Involvement," Final Report, R. L. Douglass, L. D. Filkins, and F. A. Clark, Jun 1974, Highway Safety Res. Inst., Mich. Univ., Ann Arbor; Contract DOT-HS 031-3-754.  
Availability: See publication

HS-015 331

# THE DEVELOPMENT OF THE GREEN CROSS CODE

Production of a code for pedestrians crossing the road is described. Some hundreds of mothers of young children, road safety officers, and teachers were asked to assess the relative importance of 20 items concerned with crossing roads safely. There was considerable agreement about priorities and, based on this, some alternative forms of a new crossing code were devised. A total of 294 children between five and seven were questioned at the roadside to see whether they could understand these terms and phrases. On a basis of the results, what appeared to be the best wording was chosen, and 170 children aged seven and eight were tested at the roadside to find out whether they could carry out the instructions. Their ability to read the code was also tested. The results were satisfactory and the new code was publicized later as the Green Cross Code. This publicity was associated with an 11% reduction in child casualties, even though 16 months later a survey among 595 children aged 7-15 showed that most of them could not say what the content of the code was very exactly.

by K. J. Sargent; D. Sheppard  
Transport and Road Res., Lab., Crowthorne, Berks. (England)  
1974 ; 39p 5refs  
Availability: Corporate author

HS-015 332

# THE EFFECT OF COMMERCIAL VEHICLES ON INTERSECTION CAPACITY AND DELAY. FINAL REPORT

The effects of commercial vehicles on intersection capacity and delay were examined in terms of an equivalency factor of passenger cars to commercial vehicle at a signalized intersection, the travel time delay, and the effect of intersection corner radii on commercial vehicle turning movements. Regression equations were developed which explained over 90% of the variation in 16 original commercial vehicle equivalency factors. Study of 23 signalized intersection approaches showed that a passenger car's average running travel time through an intersection was increased from 39.8 to 49.4 sec when one or more commercial vehicles were traveling ahead of it, although the presence of trucks did not significantly increase or decrease the average stop time for a passenger car. A regression model predicted the average commercial vehicle delay at any given signalized intersection, explaining 87.1% of the variation in the average commercial vehicle delay at the 23 approaches studied. It was found that for a curb radii range of 30-50 ft, a 30-ft curb radius caused the delay for a passenger car following a single unit truck, and a 50-ft radius caused the least delay for a passenger car following a combination. Curbing also decreased the right turn speed of cars and truck combinations but not single unit trucks.

by T. H. Yurysta  
Joint Hwy. Res. Proj., Lafayette, Ind.  
Rept. No. JHRP-74-8 ; 1974 ; 114p 39refs  
Prepared in cooperation with the Indiana State Highway Commission and Purdue Univ.  
Availability: Purdue Univ., West Lafayette, Ind.

HS-015 333

# ANALYSIS OF MOTOR VEHICLE ACCIDENTS AT COMMERCIAL DRIVEWAY LOCATIONS. FINAL REPORT

The significance of driveway accidents on commercial arterial highways was determined; roadway, driveway, and land use characteristics related to driveway accidents were examined; and factors having significant effect on driveway accidents were investigated. Data were collected in five central Indiana cities for 14 roadway sections over a three-year period. It was found that 33% of all traffic accidents on sections of arterial highways serving commercial land use were driveway accidents. Stepwise regression analysis performed at three levels showed interactions among terms to be good predictors of driveway accidents. It was found that the driveway volume and combinations of the roadway and driveway volumes were significant in predicting driveway accident rates. A model was also developed to predict the number of driveway accidents per mile per year of a roadway section serving commercial land uses. It was shown that the roadway average daily traffic; the ratio of medium plus high volume driveways per mile divided by the total driveways per mile, and the driveway volume per mile; predicted 82.6% of the variability of the driveway accidents per mile per year.

by D. A. Uckotter  
Joint Hwy. Res. Proj. Lafayette, Ind.  
Rept. No. JHRP-74-9 ; 1974 ; 90p 45refs  
Prepared in cooperation with the Indiana State Highway Commission and Purdue Univ.  
Availability: Purdue Univ., West Lafayette, Ind.

HS-015 334

**EFFECTS OF BICYCLE LANES ON TRAFFIC FLOW.  
FINAL REPORT**

Vehicular speed and displacement on streets where bicycle lanes exist were measured quantitatively in four study sites in West Lafayette, Indiana. Research was conducted over five months and was divided into three phases (light, medium, and heavy bicycle flow rates). It was found that on narrow roads both a significant reduction of speed and displacement occurred when a motorist encountered a bicyclist in the traffic stream. For wide roads with higher speeds, the speed reduction still was evident although displacements were not as significant since the motorist had some added psychological comfort of the wide road. It was also determined that motor vehicles in the opposing traffic lane had less effect on the motorist than did a bicyclist. The research showed that a peak-hour does exist for bicycles, and that the bicycle is being used as an alternative mode of transportation by both students and members of the community. It is recommended that similar studies be undertaken to establish some additional criteria for bicycle lane placement and to find ways of providing additional protection to the bicyclist.

by R. J. Jilla  
Joint Hwy. Res. Proj., Lafayette, Ind.  
Rept. No. JHRP-74-10; 1974; 125p 41refs  
Prepared in cooperation with the Indiana State Hwy.  
Commission and Purdue Univ.  
Availability: Purdue Univ., West Lafayette, Ind.

HS-015 335

**SPECIAL TRAFFIC SPEED REPORT. SPEEDS ON  
INDIANA HIGHWAYS UNDER VOLUNTARY 55 MPH  
AND MANDATORY 55 MPH AND 70 MPH  
MAXIMUM SPEED LIMIT**

The effect of the 55 mph-speed limit on maximum free-flowing speeds was evaluated by analyzing spot speed observations made during May 1974 at three Indiana locations, tangent sections of rural highways, during daylight hours and under favorable conditions. The spot locations were on interstate, four-lane, and two-lane highways. Analysis of the speeds showed the overall average speed for passenger cars was 58.40 mph and 55.12 for heavy trucks, reductions of 6.80 and 3.68 mph over the preceeding year. Tabular data on the average speeds are included. It was also shown that more cars were travelling at or near the same speed on the roadway, a factor which has been found to result in the lowest accident rate.

by A. Gadallah; G. Stafford; H. L. Michael  
Joint Hwy. Res. Proj., Lafayette, Ind.  
1974; 6p  
Prepared in cooperation with the Indiana State Highway  
Commission and Purdue Univ. See HS-014 842.  
Availability: Corporate author

HS-015 336

**COST OF OPERATING AN AUTOMOBILE**

Three cars (a standard size four-door sedan, an American-made compact, and a subcompact) were compared in terms of costs incurred by the consumer, and in relation to the highway-user taxes paid. Factors considered were repairs, repetitive maintenance operations, replacement items, in-

surance, and other cost. Including depreciation, state and federal taxes, gas and oil, and garage, parking, and tolls, the subcompact size is shown to be the most economical in a suburban based operation, costing 11.2 cents per mile. Compact cars cost 12.9 cents and standard size, 15.9 cents.

by L. L. Liston; R. W. Sherrer  
Federal Hwy. Administration, Washington, D. C.  
1974; 11p  
Availability: Corporate author

HS-015 337

**CHEMICAL ANALYSIS OF DIESEL EXHAUST ODOR  
SPECIES**

A good correlation between exhaust odor intensity and abundance of the partial combustion products of diesel engines is shown. An analytical method was developed, based on liquid chromatography, for the quantitative expression of exhaust odor intensity by measurements of the smoky-burnt odor group. Initial survey studies reveal the method to be applicable over a wide odor emission range. Fuel variation has little effect, whereas injector variables do influence odor intensity.

by P. L. Levins; D. A. Kendall; A. B. Caragay; G. Leonardos; J. E. Oberholtzer  
Little (Arthur D.), Inc., Cambridge, Mass.  
Rept. No. SAE-740216; 1974; 12p 11refs  
Presented at Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974. Sponsored by the Coordinating Res. Council  
(Proj. CAPE-7-68) and the Environmental Protection Agency.  
Availability: SAE

HS-015 339

**THE BEGINNING RIDER COURSE FOR NOVICE  
MOTORCYCLE RIDERS OF ALL AGES**

The beginning motorcycle rider course contains what is presently known about motorcycle operation and is designed to meet the immediate needs of those preparing users to ride motorcycles. Specific sections are given on: self-test of understanding the course; knowing the motorcycle (controls and devices, inspection); preparing to ride (protective gear usage, mounting, starting, shutting off and dismounting, parking); riding the motorcycle (safety rules, walking the motorcycle, rear braking); fundamental skills (turning, gear changing, braking); routine riding situations (signalling, using lights, high speed riding, standing on pegs, riding on different surfaces, carrying passengers); riding in traffic (traffic awareness techniques, identifying hazards, predicting and avoiding conflicts); maintenance and insurance.

Motorcycle Safety Foundation, Inc., Washington, D. C.  
1974; 64p  
See also HS-015340 and HS-015 341.  
Availability: Corporate Author, 6755 Elkridge Landing Road,  
Linthicum, Md. 21090, \$1.50

HS-015 340

**THE BEGINNING RIDER COURSE. STUDENT  
WORKBOOK**

A student workbook is presented for a beginning motorcycle rider course which deals with immediate needs of new riders.

February 28, 1975

HS-015 348

Eight learning experiences are detailed, with practice exercises given for each. They include: understanding the course; knowing the motorcycle; preparing to ride; riding the motorcycle; fundamental motorcycle riding skills; routine riding situations; riding in traffic; and maintenance and insurance. Specific exercises have to do with: inspection, protective equipment, starting and mounting, walking the motorcycle, turning and changing gears, turning, signalling, using lights, high speed driving, traffic awareness, and intersecting.

Motorcycle Safety Foundation, Inc., Washington, D. C.  
1974 ; 36p  
See also HS-015 339 AND HS-015 341.  
Availability: Corporate Author, 6755 Elkridge Landing Road,  
Linthicum, Md. 21090, \$1.00

HS-015 341

#### **THE BEGINNING RIDER COURSE. INSTRUCTOR'S GUIDE**

An instructor's guide for a beginning motorcycle rider course is presented. Learning experiences are described for: training in basic control skills; knowledge of safe riding procedures; hazard perception training; procedures for coping with emergencies; and basic cycle maintenance. Selected resources and references are included along with a film resource list.

Motorcycle Safety Foundation, Inc., Washington, D.C.  
1974 ; 36p 57refs  
See also HS-015 339 AND HS-015 340.  
Availability: Corporate Author, 6755 Elkridge Landing Road,  
Linthicum, Md. 21090, \$2.50

HS-015 342

#### **HIGHWAY ACCIDENT REPORT. AUTOMOBILE CRASH OFF THE SILLIMAN EVANS BRIDGE, I-24/65, NASHVILLE, TENNESSEE, JULY 27, 1973**

The crash of a passenger car through the barrier system on the edge of the Sillman Evans Bridge (I24/65) in Nashville, Tennessee is described. Of the nine occupants, the driver and seven passengers died. There was no fire or ejections. The probable cause is found to be the failure of the driver to maintain her vehicle in the pathway provided. Contributing factors which may have confused her were: increasing curvature of the ramp; narrowing of the ramp from two lanes to one; a misleading traffic control sign; misleading pavement marking; and an inadequately delineated and unnecessary section of a concrete island which narrowed the pathway to less than the width of a normal traffic lane, all in the last 600 ft. of the ramp. Recommendations are included to the FHWA and state to prevent the recurrence of this type of accident.

National Transp. Safety Board, Washington, D.C.  
Rept. No. SS-H-28; NTSB-HAR-74-2 ; 1974 ; 45p 7refs  
Availability: NTIS

HS-015 343

#### **ACCIDENT AVOIDANCE SEMINAR. PT. 2, STEERING, HANDLING AND BRAKING. THE INFLUENCE OF ROAD CHARACTERISTICS (SLOPE, INCLINATION, BENDS), OF THE ENGINE-BRAKING MOMENT AND OF THE ROTATING MASS ONTO**

#### **THE BRAKE-FORCE DISTRIBUTION AND ON THE BRAKE-CIRCUIT SPLITTING**

Considerations related to rating vehicular brake systems are discussed. Brake system rating is based on the parabola of the ideal brake-force distribution, with the locus of the center of gravity as to the coordinates of its height and length including the wheelbase taken into account; Alternative methods are examined, along with the concept of braking efficiency, and are assessed in terms of brake standards legislation.

by M. Burckhardt  
Daimler-Benz A. G., Stuttgart (West Germany)  
Publ: HS-013 939, International Technical Conference on  
Experimental Safety Vehicles, (4th) Washington, 1973 p517-24  
1973  
Presented at the Conference held in Kyoto Japan 13-16 Mar  
1973  
Availability: BOUND IN HS-013 939

HS-015 347

#### **A TECHNOLOGY ASSESSMENT OF THE TRANSITION TO ADVANCED AUTOMOTIVE PROPULSION SYSTEMS**

In a technology assessment of the transition to advanced automotive propulsion systems, several areas are covered: energy, materials, environment, transition modeling, socioeconomic, and transition results and interpretation. Focus is on the interrelationships and impacts resulting from the changeover from the internal combustion engine to alternate propulsion systems. Baseline data on internal combustion engine characteristics are given, along with characterization of advanced systems, policy alternatives with scenario descriptions, sensitivity results, and government policy options.

by D. G. Harvey; W. R. Menchen  
Hittman Associates, Inc., Columbia, Md.  
CONTRACT NSF-C674  
Rept. No. HIT-541 ; 1974 ; 477p refs  
Availability: Corporate author

HS-015 348

#### **AUTOMOTIVE HIGH-DENSITY DIGITAL TAPE RECORDING SYSTEM**

A high-packing-density digital tape recorder developed for long-term mobile recording of low-frequency analog input data is described. The recorder operates unattended directly from the car battery and offers significant advantages over conventional FM instrumentation tape recorders in size, power, weight, channel count, and record time. A separate playback unit enters the digital data directly into a computer for analysis and provides an analog reconstruct of any one of the input channels for graphic analysis. The recording system is discussed with the aid of a functional block diagram, and samples of reconstructed data from actual road tests are presented

to illustrate the performance of the recorder in a severe shock and vibration environment.

by T. J. Flis; F. B. Cupp  
Ford Motor Co., Dearborn, Mich.; Edmac Associates, Inc.  
East Rochester N. Y.  
Rept. No. SAE-740219; 1974; 12p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 349

### APPLICATION OF SENSITIVITY ANALYSIS TO VEHICLE DYNAMICS

The application of sensitivity analysis to automobile dynamics is described, with the sensitivity equation and complex sensitivity equation generalized in matrix form. The sensitivity analysis was applied to a simple model of steering system in terms of the Japanese experimental safety vehicle specifications. With sensitivity grasped as a function of time, the effects of parameters on dynamic characteristics of the system can be physically understood, although the sensitivity analysis technique is particularly effective when the system includes many parameters.

by A. Watari; S. Iwamoto  
Publ: Vehicle System Dynamics v3 n1 p1-15 (Jun 1974)  
1974; 3refs  
Availability: See publication

HS-015 350

### IMPROVEMENTS IN DYNAMIC CHARACTERISTICS OF AUTOMOBILE SUSPENSION SYSTEMS. PT. 1. TWO-MASS SYSTEMS

Linear models which consider unsprung mass in an automobile suspension system are described. Two configurations of masses are investigated: a two-mass system consisting of a sprung mass and an unsprung mass, and a three-mass system having an additional mass which acts as a vibration absorber. The gain in comfort obtained by lowering the natural frequency of the sprung mass is calculated for various two-mass and three-mass models along with other characteristics such as the dynamic tire load, spring and damper forces, and relative motion of the masses.

by D. Ryba  
Publ: Vehicle System Dynamics v3 n1 p17-45 (Jun 1974)  
1974; 4refs  
Availability: See publication

HS-015 351

### ZUR STEUERBARKEIT EINES GEBREMSTEN SATTELSCHLEPPZUGES (ON CONTROLLABILITY OF A TRACTOR-SEMITRAILER TRUCK DURING BRAKING)

The concept of controllability coming from linear system theory is applied to the motion of a tractor-semitrailer vehicle during straight-line braking. Some states of braking with locked up wheels at different axles are considered. The question whether the system is always controllable must be answered in the negative for locked up wheels at the tractor's

front axles. In other cases, controllability in its mathematical meaning, which does not always appear to be fully adequate for practical problems, is possible.

by H. Troger  
Publ: Vehicle System Dynamics v3 n1 p47-51 (Jun 1974)  
1974; 11refs  
Text in German. English summary.  
Availability: See publication

HS-015 352

### THE CONTROL OF RIGHT-TURNING VEHICLES AT SIGNAL-CONTROLLED INTERSECTIONS

A unique form of traffic signal-controlled highway junction in England is described in which the major highway is rechanneled to allow a right-turning movement to take place without the necessity for an additional right-turning phase or late and early start facilities. Traffic actions at both the conventional form of traffic signal approach and the unique form have been simulated and the resulting delays to right-turning vehicles compared. Field studies were used to obtain the input parameters to the simulation models and also to validate the models themselves. The suggested form of junction shows considerable reduction in delay for vehicles making a right turn. (Problems encountered by turning right in left-hand traffic are similar to those of turning left in right-hand traffic.)

by H. S. T. Al-Salman; R. J. Salter  
Publ: Traffic Engineering and Control v15 n15 p683-6 (Jul 1974)  
1974; 3refs  
Availability: See publication

HS-015 353

### LINEAR ELASTIC FRACTURE MECHANICS AND ITS APPLICATION TO FATIGUE

The major aspects of linear elastic fracture mechanics (LEFM) as a quantitative design criterion against brittle fracture are summarized. The extension of LEFM to subcritical crack growth under fatigue conditions is described, although fatigue design using LEFM assumes preexisting flaws or cracks. Fatigue is therefore based on subcritical crack growth followed by final fracture. Subcritical crack growth under both constant amplitude and variable amplitude loading is considered along with peak tensile or comprehensive overloads.

by R. I. Stephens  
Iowa Univ., Iowa City  
1974; 13p 27refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 354

### EFFECT OF PERIODIC LARGE STRAIN CYCLES ON THE FATIGUE BEHAVIOR OF STEELS

Data are reported for smooth specimens of SAE 4340, RQC-100, and Man-Ten steels subjected to constant stress amplitude cycling below the conventional fatigue limit. The presence of occasional large strain cycle, or overstrains, in the history resulted in finite lives. Possible causes of this effect

are discussed, and it is shown that the deformation response of these steels is altered by overstrain. Inelastic strain-life data for the periodic overstrain and initial overstrain tests fall on the same line in a log-log plot that represents the nonoverstrain tests at shorter lives. The use of inelastic strain as a fatigue damage parameter is discussed.

by W. R. Brose; N. E. Dowling; J. Morrow  
Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics; Westinghouse Electric Corp., Pittsburgh, Pa. Res. and Devel. Center  
Rept. No. SAE-740221 ; 1974 ; 12p 18refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974. Sponsored by the Advanced Res. Projects Agency, Dept. of Defense, and by the Fracture Control Program, College of Engineering, Ill. Univ.  
Availability: SAE

HS-015 355

#### **THE NATURE OF 2800 BICYCLE ACCIDENTS INVOLVING SCHOOL AGE CHILDREN IN LOS ANGELES**

A three-year comprehensive safety study of school-age children conducted in Los Angeles yielded 4000 pedestrian and 2800 bicycle accidents. Tables from the bicycle accident portion of the study give figures on bicyclist and driver age, sex, type of injury, and part of the body injured; school area, police jurisdiction, month, hour, and environmental factors of accident occurrence; ethnic group involved; bicyclist alone or not; intersection accidents; distance from intersection or curb; bicyclist and driver visual behavior, evasive action, and violations; direction of bicycle or vehicle; type and condition of bicycle and whether licensed or not; driver license status; part of bicycle or car hit or damaged; type and color of car; street speed limit; and whether travel was to and from school or not. A point by point comparison to Los Angeles findings with the findings of the National Transportation Safety Board's special study, "Bicycle Use as a Highway Safety Problem", is included.

by D. W. Rector  
Los Angeles Unified School District, Calif.  
1974 ; 48p  
Presented at the Third International Congress on Automotive Safety of the National Motor Vehicle Safety Advisory Council, San Francisco, 15-17 Jul 1974.  
Availability: Corporate author

HS-015 356

#### **DISTANCE JUDGMENT CAPABILITIES OF CHILDREN AND ADULTS IN A PEDESTRIAN SITUATION**

The distance judgment capability of children was compared with that of young adults in a field pedestrian situation, and the two age groups were also compared as to distance judgment capability in the laboratory and eye movement patterns when judging distances. Considerable inter-subject variability for both the estimates of the means and the standard deviations of the psychometric functions in the field and the laboratory were found. It is indicated that some form of perceptual training could benefit people who exhibit inferior distance judgment capability in pedestrian situations. The findings suggest that children aged 6-13 have not achieved the high degree of consistency in making distance judgments

which is exhibited by the adult group studied, and children could be therefore more prone to pedestrian accidents. Based upon head and eye movement results, the lower degree of distance judgment consistency exhibited by the children might be explained by factors such as a less efficient visual mechanism, a not yet fully developed distance discrimination ability and power of resolution.

by H. T. Zwahlen  
Ohio Univ., Athens, Dept. of Industrial and Systems Engineering  
1974 ; 24p 7refs  
Presented at the Third International Congress on Automotive Safety of the National Motor Vehicle Safety Advisory Council, San Francisco, 15-17 Jul 1974.  
Availability: Corporate author

HS-015 357

#### **IMPACT OF SAFETY, ENERGY, AND EMISSION REQUIREMENTS ON VEHICLE DESIGN**

Safety, damageability, emission, and noise regulations are discussed which require major compromises in other desirable automobile characteristics. Fuel economy, acceleration performances, and cost are jeopardized in the design tradeoffs required. Primary vehicle design interactions occur through the influence of regulations on vehicle weight and on powertrain efficiency and performance. It is concluded that the effectiveness of regulations must be examined to ensure that their net effect results in a real benefit to society.

by C. Marks; R. G. Fischer; E. E. Stewart  
General Motors Corp., Engineering Staff, Warren, Mich.  
1974 ; 25p 21refs  
Presented at the Third International Congress on Automotive Safety of the National Motor Vehicle Safety Advisory Council, San Francisco, 15-17 Jul 1974.  
Availability: Corporate author

HS-015 358

#### **THE NATURE OF BICYCLIST ACCIDENTS AND INJURIES**

Elementary age children, who comprise a significant portion of bicycle users and casualties and who are the most susceptible to countermeasure programs, were surveyed as to bicycle accidents and injuries. The survey reconciles the difference of pedalcycle accident rates from different sources, and demonstrates that those who report accidents at least do not represent themselves or their riding habits much differently than those who do not. It also shows that accident details generally parallel exposure data and are basically similar by geographical area, and that adult bicycle experiences are similar to children's. It is concluded that countermeasures should consider: the early age children learn to ride; the non-transportation nature of children's riding; injury causes not related to motor vehicles; the hazardous 2-4 p.m. riding time; and accident patterns.

by T. Chlapecka  
National Safety Council, Chicago, Ill.  
1974 ; 11p  
Presented at the Third International Congress on Automotive Safety of the National Motor Vehicle Safety Advisory Council, San Francisco, 15-17 Jul 1974.  
Availability: Corporate author

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### **A CONTRIBUTION TOWARDS BETTER COMPATIBILITY BETWEEN VEHICLES**

A method for obtaining the required level of compatibility between vehicles is defined, a realistic analysis is carried out, and theoretical and practical studies are described. Compatibility is shown to be a real way of increasing the chances of survival in collision involving cars of very different types. The heavy car must be as welcoming as it is heavy; it also must be able to stand crashes against fixed obstacles. To avoid extra lengthening, the stiffness of the small car must be calculated for the maximum deceleration its restraint can undergo. To better the performances of restraints, the delay of their action must be reduced, and the crash duration increased at any given speed variation level.

by P. Ventre  
Renault-Peugeot Assoc., La Garenne-Colombes (France)  
1974 ; 32p 8refs  
Presented at the Third International Congress on Automotive Safety of the National Motor Vehicle Safety Advisory Council, San Francisco, 15-17 Jul 1974.  
Availability: Corporate author

HS-015 360

### **AUTOMOBILE-UTILITY TRAILER COMBINATIONS ON RURAL HIGHWAYS IN KENTUCKY**

Accidents records analysis indicated that automobile-utility trailer (AUT) combinations are involved in a disproportionately high number of traffic mishaps. Examination of the history of accidents involving AUT vehicles indicated that differential crosswinds and unanticipated driving maneuvers contribute to the driver's loss of control. AUT combinations contributed to the fatigue loss in pavement life approximately 50% as much as single-unit, two-axle, six-tire trucks (per vehicle). In general AUT vehicles constituted approximately 3% of the total traffic stream. Analysis of speed distributions indicated an equivalency factor for AUT combinations equal to that for trucks for similar roadway types and topological conditions.

by B. S. Siria; R. C. Deen  
Publ: Transportation Research Record n489 p19-33(1974)  
1974 ; 8refs  
Sponsored by TRB Com. on Vehicle Characteristics, on Vehicle Inspection and Regulation, and Com. on Highway Capacity and Quality of Service.  
Availability: See publication

HS-015 361

### **INSPECTION HANDBOOK FOR PASSENGER CARS, TRUCKS AND BUSES, MOTORCYCLES, SCHOOL BUSES, FOREIGN VEHICLES, THROUGH 1974 MODELS WITH MANUFACTURER RECOMMENDATIONS**

A 1974 edition of an inspection handbook for passenger cars, trucks and buses, and school buses is presented. Manufacturers' recommendations are included. Procedures are given for registration, wheels and tires, steering alignment and suspension, brakes, lighting and electrical systems, vehicle glazing, body and sheet metal, exhaust and fuel systems, and

vehicle emission control systems. (This edition contains no material on motorcycles or foreign vehicles.)

Motor Vehicle Manufacturers Assoc., of the United States, Inc., Detroit Mich.  
1974 ; 328p  
Prepared in cooperation with the American Assoc. of Motor Vehicle Administrators. Cover title: Vehicle Inspection Handbook. Edition for 1969 is HS-009 645a; 1970 is HS-009 645; 1973 is HS-013 828.  
Availability: Corporate author

HS-015 362

### **SPEED REPORT**

Speed characteristics of the majority of vehicle operators on the Michigan truckline system are summarized in a quarterly report. Data are from 25 rural and one urban speed locations throughout the state, surveyed for both day and night driving. Road characteristics at the speed study sites are described, and statistics are given for vehicular speed trends by types and by road location. Both daytime and nighttime average car, commercial vehicle, and bus speeds are shown to have reduced over the previous year.

Michigan Dept. of State Highways and Transp., Lansing  
Rept. No. MDSHT-R-66 ; 1974 ; 86p  
Prepared in cooperation with the U. S. Dept. of Transp., Federal Highway Admin.  
Availability: Corporate author

HS-015 363

### **STUDY GROUP RECOMMENDS CHANGES IN DRIVER EDUCATION**

Public school driver training program transfer to commercial firms in California is recommended. A university engineering study group emphasizes the money to be saved by using such commercial firms, \$50 versus \$70 per student in high school systems. Opposition to the proposal by some school superintendents and insurance companies, few of which will give a rate reduction for training in commercial schools, is cited. It is suggested that the on-the-road training be done by commercial firms, while the classroom instruction remain the responsibility of the school system. The importance of student driver attitude is emphasized. Both classroom and on-the-road instruction would be subject to the approval each year by the State Department of Public Instruction, according to rules formulated by the National Commission on Safety Education.

by W. L. Roper  
Publ: California Highway Patrolman v38 n6 p16-7, 64-5 (Aug 1974)  
1974  
Availability: See publication

HS-015 364

### **BEFORE YOU BUY THAT MINI-BIKE**

The growing popularity of minibikes is described, with emphasis on safety considerations. It is suggested that the death rate of minibike riders is probably higher than that for motorcyclists, which is about six times higher than that for automobile drivers. The young age of mini-bikers is noted. Various designs and specifications are examined, along with regulation,



control and licensing procedures. Guidelines are offered for choosing a proper mini-bike for a child, suggestions are made for keeping it in good condition, and safety rules for its operation are recommended. Mini-bike racing precautions, protective clothing, and educational efforts are also discussed.

by R. York  
Publ: California Highway Patrolman v38 n6 p10-2, 47, 50, 52-3  
(Aug 1974)  
1974  
Availability: See publication

HS-015 365

### THE EFFECT OF COMPOSITION AND MICROSTRUCTURE ON THE PITTING FATIGUE OF CARBURIZED STEEL CASES

The pitting fatigue of a wide range of heat-treated carburizing steels was investigated. The effects of compositions conforming to 1024, 8620, 4620, 4027, 2048, 4419, 4817, and 9310 at two levels of case carbon content were studied in lubricated concentrated contact. Different microstructures were produced in the 4817, and 9310 steels by combination of case carbon level and subzero treatment. Testing was carried out on geared roller test machines. Pitting fatigue was found to be dependent on microstructure rather than steel composition. As long as the steel possessed sufficient hardenability to avoid transformation products, then fatigue life is not markedly different. It appears that the presence of retained austenite can improve pitting fatigue resistance.

by M. A. H. Howes; J. P. Sheehan  
IIT Research Inst., Chicago, Ill.; Packer Engineering Associates, Inc., Naperville, Ill.  
Rept. No. SAE-740222 ; 1974 ; 23p 4refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 366

### FATIGUE CRACK GROWTH DELAYS

The effects of single and multiple tensile overloads on precracked center-notched sheet specimens of Ti-8 Al-1 Mo-1V titanium alloy were investigated under laboratory conditions. Single tensile overloads always delayed subsequent fatigue crack growth at lower stress levels. Multiple tensile overload caused a delay in fatigue crack growth greater than a single overload, with the amount depending on the number of overloads. The quantitative values of fatigue crack growth delay are reported for overloads ranging from 116-233%. Single intermittent overloads applied within the delay caused by previous overloads produced the greatest delays. Conditions subsequent to overloading and encountered in realistic environment (including time at zero load, temperature, and a seawater environment) were found to reduce the delay effects greatly and should be incorporated into theoretical models. These effects are explained in terms of fatigue crack closure concepts.

by R. Dubensky  
Ford Motor Co., Dearborn, Mich.  
Rept. No. SAE-740223 ; 1974 ; 20p 41refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 367

### FLOW THROUGH CATALYTIC CONVERTERS--AN ANALYTICAL AND EXPERIMENTAL treatment

A method for measuring and comparing the flow distribution of a monolithic catalytic converter is developed and the important parameters influencing flow are determined. The pressure losses through a converter are measured and analyzed, and a theoretical relationship between flow distribution and converter life is developed.

by C. D. Lemme; W. R. Givens  
Maremont Corp., Chicago, Ill.  
1974 ; 14p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 368

### FLOW EFFECTS IN MONOLITHIC HONEYCOMB AUTOMOTIVE CATALYTIC CONVERTERS

Durability test results of monolithic catalytic converters with mechanical devices used to tailor the exhaust gas flow are described. Deflectors of several different shapes show promise of extending the useful life of the converter by improving conversion efficiencies of hydrocarbons and carbon monoxide. The tests were run on engine/dynamometers with round cross-sectional area samples and with symmetrical inlet cones. Improvements are found in initial activity and reduced deterioration. The penalty for altering the flow is in slower catalyst light-off and increased pressure drop. Sequential photographs of catalyst light-off with different flow distributions are included as well as postmortem analysis of catalyst loading and poison deposition. The potential benefits appear to be a result of a more balanced exhaust gas flow over the monolith cross section, which provides more effective use of the catalyst.

by J. S. Howitt; T. C. Sekella  
Rept. No. SAE-740244 ; 1974 ; 10p 5refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 369

### CATALYTIC CONVERTER DURABILITY TESTING WITH PORTABLE ENGINE DYNAMOMETERS

A test facility using engine dynamometers to age catalyst is discussed. The engine operating parameters and thus the input to the catalyst were set to duplicate the environment of the catalyst during vehicle test on the Federal Appendix D Durability Schedule. Results from the experimental car durability test show that the primary cause of catalyst performance loss on this schedule has been due to contamination build-up on the catalyst surface. Catalyst aged on the engine dynamometer facility has shown very good performance loss correlation to similar catalyst aged in the vehicle test. This correlation has allowed the use of this engine dynamometer facility to in-

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investigate various catalyst parameter effects on the durability performance of the catalyst.

by B. D. Lockhart; S. L. Genslak  
General Motors Corp., Warren, Mich. Engineering Staff  
Rept. No. SAE-740245 ; 1974 ; 29p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 370

### **A TECHNIQUE FOR ENDURANCE TESTING OF OXIDATION CATALYTIC REACTORS**

The effects of two methods of engine test-bed aging on catalyst deterioration are compared with the normal vehicle endurance test. The test-bed engines caused a higher rate of catalyst deterioration than the vehicle, and there are indications that this effect is related to the intake mixture strength of the engine. From the experiments a technique for accelerated catalyst aging was derived. The reactor is aged on a test bed for three periods, each of 100 h. At the 0, 100, 200, and 300 h stages, the reactor is removed from the test bed and transferred to another engine for detailed tests of catalyst performance. A 1975 CVS test on a vehicle is also included in each set of experiments. Results from some of the catalytic reactors, tested by this technique, are presented.

by R. A. Haslett  
Ricardo and Co. Engineers Ltd., Dorchester, Dorset (England)  
1974 ; 12p 1ref  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974. Prepared in cooperation with Johnson Matthey Ltd.  
Availability: SAE

HS-015 371

### **THE INFLUENCE OF VEHICLE PARAMETERS ON CATALYST SPACE VELOCITY AND SIZE REQUIREMENTS**

An empirical relationship which permits the sizing of catalytic converters for control of vehicle exhaust emissions when the converter operates under mass transfer limited conditions is described. The relationship is based upon the inertia weight only, and may be utilized--within certain limitations--to determine the size of catalyst required for a given vehicle when another vehicle, which is equipped with a catalyst of proven durability, is used as a reference.

by J. G. Hansel; K. Aykan; J. G. Cohn  
Engelhard Minerals and Chemicals Corp., Menlo Park, N. J.  
Engelhard Industries Div.  
Rept. No. SAE-740247 ; 1974 ; 6p 1ref  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 372

### **FUEL EFFECTS ON OXIDATION CATALYSTS AND OXIDATION CATALYST SYSTEMS, PT. 2**

The effects of lead on noble metal automotive oxidation catalysts were studied using engine and chassis dynamometer units as well as laboratory evaluations. Work was carried out

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with monolithic and pelletized catalysts and with lead levels ranging from trace to 3.5 g/gal. Engine and chassis dynamometer studies with monoliths confirmed earlier findings that trace lead up to the 0.07-0.10 g/gal level has almost no effect on activity maintenance during long term aging. At higher trace levels, deactivation effects become apparent over the long term. Brief exposures to fully leaded fuels in dynamometer or customer testing do not seem to affect catalyst life. Initial testing of beaded catalysts indicates that they are no more sensitive to traces of lead than monoliths. Catalysts subjected to dynamometer aging for the equivalent of 25,000 miles with fuel containing 0.10 g/gal of lead easily met carbon monoxide and hydrocarbon emission standards. Laboratory studies of aged catalysts showed a correlation between lead content and activity, with the first increments of leading causing the greatest deactivation. These results contradict vehicle test results showing a linear deactivation trend with lead accumulation. An effect on hydrocarbon conversion activity of oxygen concentration was also found.

by E. L. Holt; E. E. Wigg; A. H. Neal  
Esso Res. and Engineering Co., Linden, N. J.; Esso Res. Labs., Baton Rouge, La.  
Rept. No. SAE-740248 ; 1974 ; 14p 5refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 373

### **NITROGEN OXIDE REMOVAL CATALYSTS FOR PURIFICATION OF AUTOMOBILE EXHAUST GASES**

The chemistry involved in the selective catalytic reduction of oxides of nitrogen (NOx) to nitrogen is outlined and the requirements of a practical NOx reduction catalyst are summarized. The effects of temperature, gas composition, NOx concentration, and sulfur dioxide on the activity of some potential NOx catalysts were studied. Steady-state engine dynamometer endurance runs with ruthenium and non-ruthenium catalysts are described, and some vehicle durability data with particulate and monolithic base metals containing NOx catalysts are also presented.

by D. R. Ashmead; J. S. Campbell; P. Davies; K. Farmery  
Imperial Chemical Industries Ltd., Welwyn Garden City, Herts. (England)  
Rept. No. SAE-740249 ; 1974 ; 11p 9refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 374

### **STABILIZED RUTHENIUM CATALYSTS FOR NITROGEN OXIDES REDUCTION**

Some of the problems encountered in the use of ruthenium as an oxides of nitrogen (NOx) reduction catalyst are described. The major problem of volatilization in high temperature oxidizing atmospheres was overcome by providing a stabilizing matrix for the ruthenium. The stabilized catalyst, however, does not have good carbon monoxide and hydrocarbon oxidizing performance, such as is required when the NOx catalyst is used for oxidation under cold start conditions. Coinpregnation of Pt and Ru is ineffective in improving this situation, and it was necessary to develop a novel procedure to improve catalyst oxidation activity. Engine dynamometer tests showed

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that the final catalyst performs well under all of the conditions to which it is subjected.

by T. P. Kobylinski; B. W. Taylor; J. E. Young  
Gulf Res. and Devl. Co., Pittsburgh, Pa.  
Rept. No. SAE-740250 ; 1974 ; 8p 9refs  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 375

#### **FACTORS AFFECTING DUAL CATALYST SYSTEM PERFORMANCE**

Results of warm-up and fuel economy studies on a dual catalyst system using GEM reinforced Ni-Cu oxides of nitrogen (NOx) reduction catalysts and PTX-11 B oxidation catalysts are reported. Methods of inducing oxidations are described. Studies conducted on a 1973-350 CID Chevrolet indicate a fuel penalty for increasing temperature by richer carburetion and air bleed at constant spark timing, and also a penalty for spark retard at constant carburetion. Reducing the fuel economy penalty associated with meeting stringent NOx emission standards with dual catalyst systems will require the development of durable NOx reduction catalysts which show high activity at normal exhaust temperature.

by R. J. Lang; W. R. Leppard; L. S. Bernstein  
Esso Res. and Engineering Co., Linden, N. J.  
Rept. No. SAE-740252 ; 1974 ; 12p 7refs  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 376

#### **CAN ADHESIVES HELP YOU?**

The widespread use of adhesives is reviewed and reasons for their popularity are given. Common types of adhesives are presented with examples of their use. The life expectancy of adhesive bonds is also discussed, along with some of the problems to be expected when converting to adhesive bonding.

by G. L. Schneberger  
General Motor Inst., Flint, Mich.  
Rept. No. SAE-740253 ; 1974 ; 4p 2refs  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 377

#### **ANAEROBICS--AN ANSWER TO THE IDEAL GASKET SEARCH**

A new anaerobic material is described which overcomes many of the problems associated with preformed, precut, and other formed-in-place gaskets. This new material does not migrate or drip, can be applied by either tracing or stenciling, offers in-

stant sealing capability, and cures upon confinement into a tough, nonrelaxing gap-filled solid.

by J. W. Paris  
Loctite Corp., Newington, Conn.  
Rept. No. SAE-740255 ; 1974 ; 7p  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 378

#### **BONDING OF FRP STRUCTURES WITH ROOM TEMPERATURE CURING ACRYLIC ADHESIVES**

The basic properties of a class of modified acrylic adhesives and their properties as structural adhesives of general interest to the transportation industry are described. The adhesives bond well to metallic and nonmetallic substrates and may also be used to bond dissimilar materials such as aluminum to glass fiber reinforced polyester (FRP). These room temperature curing structural adhesives equal or exceed the inherent strengths of many engineering thermoplastics. Static and dynamic adhesive durability studies have been carried out. Bonding of FRP structures requires some surface preparation prior to application, but then modified acrylic adhesive bond strengths are superior to either room temperature (RT) epoxy or urethane adhesive bond strengths. The RT cures can be thermally accelerated to give more durable bonds. Some durability data for the acrylic, an RT epoxy and a urethane are compared.

by J. F. Coleman  
Goodrich (B. F.) Chemical Co., Cleveland, Ohio  
Rept. No. SAE-740256 ; 1974 ; 5p 8refs  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 379

#### **ADHESIVELY BONDED LAMINATED METAL STRUCTURE**

Adhesively bonded metallic laminates are a fabrication concept for providing fail-safe structure, which was evaluated under an Air Force study contract. Development of a bonding process for large-area bonding adhesives test data, and component test data from the program are discussed.

by R. J. Stout  
General Dynamics Corp., Fort Worth, Tex. Convair Aerospace Div.  
Rept. No. SAE-740259 ; 1974 ; 10p 5refs  
Presented at the Automotive Engineering Congress, Detroit, 25  
Feb-1 Mar 1974.  
Availability: SAE

HS-015 380

#### **HOT MELT BONDING WITH HIGH-STRENGTH THERMOPLASTIC RUBBER POLYMERS**

The application of Kraton thermoplastic rubber as a raw material for hot melt adhesives is discussed. The physical and chemical properties of Kraton thermoplastic rubber resulting from its unique molecular structure are described. This structure indicates that the raw material is tough and elastic in addition to being soluble. A two-phase system is formed with the

midblock being the continuous phase and the endblocks the dispersive phase. Basic to the formulator's understanding is this two-phase system. Practical starting formulations are given and general principles of Kraton thermoplastic rubber are outlined, enabling the formulator to adapt the raw material to his specific needs.

by J. J. Bell; W. J. Robertson  
Shell Chemical Co., Houston, Tex. Elastomers Technical Center  
Rept. No. SAE-740261 ; 1974 ; 10p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 381

### **MATERIAL AND DESIGN GUIDELINES FOR REINFORCED THERMOPLASTIC BODY PANELS**

New reinforced thermoplastic materials are described which have been developed for rigid exterior, painted automobile panels. Traditionally these panels have been fabricated from zinc die cast, steels, or sheet molding compound. Injection molding is being applied to mineral filled nylon fiber glass reinforced nylon, and fiber glass reinforced thermoplastic polyester rigid automotive panels that are painted car color for 1974 Chevelles, Cadillacs, Pontiacs, Oldsmobiles, and Buicks. The applications, material properties, paint performance, and design recommendations for these three reinforced thermoplastic materials are reviewed.

by C. R. Grimball; N. J. Jackson  
General Motors Corp., Anderson, Ind. Guide Lamp Div.  
Rept. No. SAE-740262 ; 1974 ; 15p 5refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 382

### **GLASS REINFORCED NYLON 6 COPOLYMERS. A NEW LEVEL OF PERFORMANCE**

Using chemical alteration of the polymer chain, Capron (trademark) Nylon Copolymers offer a high degree of flexibility and impact resistance at both low and ambient temperatures. Using several different Capron Copolymers as base materials, various levels of fiberglass have been incorporated, resulting in high heat distortion temperatures and increased dimensional stability, coupled with improved impact resistance. The comparison of glass reinforced Capron Copolymers with glass reinforced homopolymers show these unique resins to possess superior impact resistance while retaining high level of stiffness and heat deflection.

by A. C. Bernardo; R. J. Welgos  
Allied Chemical Corp., Morristown, N. J.  
Rept. No. SAE-740263 ; 1974 ; 6p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 383

### **FIBER ORIENTATION IN FIBER-REINFORCED PLASTICS AND HOW IT AFFECTS AUTOMOTIVE APPLICATIONS**

The orientation of fiber-reinforced plastics and its effect in automotive applications is examined. Orientation can adversely affect molding in applications where stress is important, especially in engine components such as front timing covers, pump flanges, oil sump bosses, and crankshaft housing. The problems are discussed in detail and ways are suggested to avert serious difficulties relating to fiber orientation.

by E. M. Rowbotham  
Ford Motor Co. Ltd., Brentwood, Essex (England)  
Rept. No. SAE-740264 ; 1974 ; 13p 2refs  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 384

### **TECHNIQUES FOR BROADENING THE CAPABILITIES OF POLYPROPYLENE**

New technology is presented illustrating how polypropylene can be modified to broaden its structural capabilities beyond the limitations of present commercially available materials. Reducing weight, improving toughness, and increasing strength, stiffness, and flexibility for a variety of new automotive applications are emphasized.

by R. H. Heinold  
Hercules, Inc., Wilmington, Del. Polymers Technical Center  
Rept. No. SAE-740265 ; 1974 ; 8p  
Presented at the Automotive Engineering Congress, Detroit, 25 Feb-1 Mar 1974.  
Availability: SAE

HS-015 385

### **CONVERSION OF STATE ACCIDENT DATA TO UNIFORM ACCIDENT DATA TAPE FORMAT. STATE OF ALASKA. 1973 ACCIDENT YEAR**

Alaskan state accident data conversion to a uniform accident data tape format for the 1973 accident year is presented. The data element availability is given along with conversion statistics. Materials illustrated include police reports for traffic collisions, accident reports, file and record specifications, and codings.

Safety Management Inst., Washington, D. C.  
Contract DOT-HS-021-2-472  
1974 ; 119p  
Availability: Reference copy only

HS-015 386

### **CONVERSION OF STATE ACCIDENT DATA TO UNIFORM ACCIDENT DATA TAPE FORMAT. STATE OF ALABAMA. 1972 ACCIDENT YEAR**

The conversion of Alabama's state accident data to a uniform accident data format for the 1972 accident year is presented. Data element availability is described along with the conver-

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sion statistics. Materials illustrated include the uniform traffic accident report, instructions manual, and county and city codes.

Safety Management Inst., Washington, D. C.  
Contract DOT-HS-021-2-472  
1973 ; 146p  
Availability: Reference copy only

HS-015 387

**CONVERSION OF STATE ACCIDENT DATA TO  
UNIFORM ACCIDENT DATA TAPE FORMAT.  
STATE OF ARIZONA. 1973 ACCIDENT YEAR**

The conversion of Arizona's state accident data for the accident year 1973 to uniform accident data tape format is presented. The data element availability is described along with the conversion statistics. Materials illustrated include the traffic accident report, instruction manual and glossary, coding instructions, and accident data base.

Safety Management Inst., Washington, D. C.  
Contract DOT-HS-021-2-472  
1974 ; 298p  
Availability: Reference copy only

HS-015 388

**RECOMMENDED POLICY ON MAXIMUM  
DIMENSIONS AND WEIGHTS OF MOTOR  
VEHICLES TO BE OPERATED OVER THE  
HIGHWAYS OF THE UNITED STATES**

Legislative recommendations are offered to states for making respective codes of motor vehicle laws consistent with the policy to effect uniform motor transportation conditions throughout the nation. The policy provides, for regulation of vehicles in regular operation, for regulation of overweight and oversize vehicles operated by special permit, for issuance of special permits including assessment of permit fees, and for highway movements essential to national defense. Historic trends in motor vehicle use were considered, along with trends in vehicle weights, types, and compositions; in state regulatory limitations; and in the geometric capacities and structural capabilities of the highway system.

American Assoc., of State Hwy. and Transp. Officials,  
Washington, D. C.  
1974 ; 21p  
Prepared in cooperation with the AASHO Committees on Design, and Bridges and Structures, and the Bureau of Public Roads.  
Availability: Corporate author

HS-015 389

**URBAN TRANSPORTATION PLANNING AND AIR  
QUALITY**

Four main areas of interest concerning air pollution are discussed: legislation, information, standards, and analysis techniques. The Clean Air Act Amendments of 1970 are examined and general information on pollutants resulting from highway vehicles is summarized, including carbon monoxide, hydrocarbons, nitrogen oxides, lead particulates, and photochemical oxidants. A discussion of the relationship

between the vehicle emission standards and national ambient air quality standards is included with comments on how transportation planning is involved in meeting the air quality standards. Various techniques for analyzing the effects of highway travel on air quality including emission and diffusion models are presented;

by P. W. Blow  
Federal Hwy. Administration, Washington, D. C.;  
Rept. No. TR-33 ; 1974 ; 36p 14refs  
Prepared in cooperation with the Environmental Protection Agency.  
Availability: Corporate author

HS-015 390

**THE TEXAS PROCEDURE FOR WEIGHING TRUCKS  
IN MOTION**

The Texas procedure for weighing trucks in motion features a portable strain gauge scale installed in the pavement, with the electronic equipment used for analysis placed in a nearby van. General background information is presented along with the operating procedures, and results of several tests of the weigh-in-motion equipment. Benefits of the procedures include safety and convenience to passenger car traffic and the trucking industry. Large samples of data can be obtained on any type of highway facility, and various locations can be studied due to the portable scales and instrumentation van. Pavement roughness and the motion characteristics of vehicles are probably limiting factors that restrict the accuracy of any weigh-in-motion scale, but these limitations do not appear to affect the usefulness of weighing-in-motion for pavement design purposes. It is essential to calibrate the weigh-in-motion equipment, using a truck of known platform weight, before each operation.

by H. McCann; E. Dean; R. Bodle  
Federal Hwy. Administration, Washington, D. C.  
Rept. No. TR-36 ; 1974 ; 27p 5refs  
Availability: Corporate author

HS-801 179

**EMERGENCY MEDICAL SERVICES: A  
BIBLIOGRAPHY WITH ABSTRACTS**

The documents cited in this publication are in the NHTSA Technical Services Division collection, and can be examined there. Most of the publications cited bear a publication date of 1967 or later. Citations and abstracts are those that have previously appeared in the NHTSA Publication Highway Safety Literature. Topics covered include emergency medical services, ambulances, transportation of injured, first aid, and medical emergencies.

National Hwy. Traf. Safety Administration, Washington, D. C.  
Rept. No. SB-8 ; 1974 ; 106p refs  
Availability: NHTSA

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**TRI-LEVEL ACCIDENT RESEARCH STUDY--  
ANNUAL REPORT. FINAL REPORT**

The Tri-Level Accident Study was conducted in the eight-county Western New York area known as the Niagara Fronti-

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er. Primary emphasis is placed on data collection. This report describes the program and the data collected. One research report entitled "Factors Influencing the Performance of the Energy Absorbing Steering Column in Accidents," and three data presentations, based on study data, were completed. The presentation subjects were truck accidents, restraint system use, and severe injury accidents.

by J. W. Garrett; R. C. Braisted; D. F. Morris; D. L. Hendricks  
Calspan Corp., Buffalo, N. Y.  
Contract DOT-HS-053-3-609; CAL-7311-C226  
Rept. No. ZQ-5281-V-1 ; 1974 ; 104p 17refs  
Rept. for 1 Jan-31 Dec 1973. Sponsored by the Motor Vehicle Manufacturers Assoc., Detroit, Mich.  
Availability: NTIS

HS-801 220

**INTERNATIONAL CONFERENCE ON RESEARCH  
METHODOLOGY FOR ROADSIDE SURVEYS OF  
DRINKING-DRIVING-ALCOHOL  
COUNTERMEASURES WORKSHOP. FINAL REPORT**

International study of roadside surveys of the drinking driving problem included a review of classical and recent roadside surveys, a discussion of the methodology of roadside surveys, and a demonstration of some basic techniques by means of a special film. A manual was developed to expand some recommended survey techniques. Recommendations related to the involvement of alcoholic drivers in traffic crash morbidity and mortality were approved, dealing with minimum data to be reported on all fatal crashes, standard criteria for defining a fatal road accident, standard reporting systems in alcohol-involved accidents and voluntary roadside surveys to measure the incidence of drinking drivers in traffic. Public and law enforcement alerts to the problem and the surveys were also considered;

by B. Carr; R. F. Borkenstein; M. W. Perrine; L. C. Van Berkorn; R. B. Voas  
National Safety Council, Chicago, Ill.  
Contract DOT-HS-371-3-786  
1974 ; 183p 24refs  
Proceedings of a conference held in Paris, France, 22-24 May 1974. Includes HS-015 823; "Scientific Surveys of Alcohol in the Driving Population"; and HS-801 193.  
Availability: NTIS

HS-801 223

**MOTOR VEHICLE SAFETY DEFECT RECALL  
CAMPAIGNS REPORTED TO THE NATIONAL  
HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
BY DOMESTIC AND FOREIGN VEHICLE  
MANUFACTURERS, APRIL 1 1974-JUNE 30, 1974**

This tabulation of safety defect recall campaigns includes the make and model, model year, description of the defect requiring manufacturer's corrective action, number of vehicles recalled, date of notification, and identification number. Automobiles, trucks, motor homes, vans, trailers, tractors, school buses, utility vehicles, ambulances, buses, torque valves, tires, and helmets are included. Status of domestic and foreign campaigns completed as of Mar 31 is also included.

National Hwy. Traf. Safety Administration, Washington, D. C.  
1974 ; 38p  
Availability: GPO

HSL 75-2

HS-801 230

**FACTORS INFLUENCING ARRESTS FOR  
ALCOHOL-RELATED TRAFFIC VIOLATIONS.**

Factors found to influence police officers, arrests of persons suspected of alcohol-related (A/R) traffic violations are described, and recommendations are presented for treating these factors to achieve a higher level of enforcement. Conclusions and recommendations were derived from data obtained during a survey of 11 law enforcement agencies throughout the nation. These data included factual descriptions of recent A/R investigations, attitudinal measurements, and anecdotal information elicited from 267 police patrolmen and 85 police supervisors. Additional data were obtained through interviews of prosecuting attorneys, judges, and other civic officials. Through this survey, numerous factors were identified that positively or negatively affect the arrest/no arrest decision in A/R situations. Recommended actions for addressing these factors deal with law enforcement policies and procedures; training of patrolmen, supervisors, and commanders; the adjudication system; and legislative revisions.

by J. F. Oates, Jr.  
Dunlap and Associates, Inc., Darien, Conn.  
Contract DOT-HS-4-00837  
1974 ; 258p refs  
Rept. for Dec 1973-Aug 1974.  
Availability: NTIS

HS-801 231

**CONSTITUTIONAL PROTECTIONS OF CONVICTED  
DWI OFFENDERS SELECTED TO RECEIVE  
SPECIAL SANCTIONS--ALCOHOL  
COUNTERMEASURES LITERATURE REVIEW.  
FINAL REPORT**

Constitutional questions arise regarding the potential violation of guarantees such as due process of law, equal protection of the law for all drinking driving offenders, proper jurisdiction of the courts in imposing such sanctions, and the possible violation of constitutional rights by random assignment to rehabilitation programs. A hypothetical legislative program has been used as a model that includes the following components: all convicted driving while intoxicated (DWI) offenders be examined to diagnose the presence of aberrant drinking behavior; normal drinking drivers are subjected to traditional criminal penalties and are required to participate in a DWI school; all problem drinking drivers are subjected to legal penalties and are required to participate in a treatment program including drugs; and all diagnosed as alcoholic are subjected to traditional criminal penalties and committed. This study has lead to the conclusion that carefully drafted legislation, meeting minimal fourteenth amendment due process and equal protection requirements, will be necessary in all instances to promote the validation of such alternative sanction programs.

by J. W. Little; G. Young; S. Selk  
National Safety Council, Chicago, Ill.  
Contract DOT-HS-371-3-786  
1974 ; 35p 183refs  
Rept. for Jun 1973-Jun 1974.  
Availability: NTIS

February 28, 1975

HS-801 236

HS-801 232

**EFFECTS OF PASSIVE RESTRAINT SYSTEM DESIGN ON HORN CONTROL LOCATION AND THE LOCATION AND OPERABILITY OF STALK-MOUNTED CONTROLS. FINAL REPORT**

The possible effects of wheel-mounted passive restraint system upon control and display locations were examined, and the current status of stalk-mounted, multifunction controls and their operability were determined. Analytic, experimental, and interview methods were employed; Physical measurement of a wheel-mounted passive restraint system indicated a potential loss in usable panel area ranging from 30-70% depending on vehicle size. Experiments using more than 330 drivers indicated significantly slower reaction times were to be expected for stalk-mounted horn controls or headlight dimmer controls. Interviews with nearly 400 drivers of foreign automobiles were analyzed in terms of various stalk control configurations. Sixty-one different combinations of controls and stalks were identified among 25 vehicle makes. Rated difficulty in locating a desired control and reported errors in activating a second control instead of or in addition to the desired control varied, depending on the number of stalks and the number of controls per stalk and the types of controls. Interaction effects were also noted for type of transmission control. It was concluded that despite the apparent overabundance of stalk control configurations insufficient data were available to support standardization recommendations at this time.

Essex Corp., Alexandria, Va.  
Contract DOT-HS-120-3-679  
Rept. No. 3481-1F ; 1974 ; 84p  
Rept. for Jun 1973-Jul 1974.  
Availability: NTIS

HS-801 234

**DRIVER PERFORMANCE MEASUREMENT AND ANALYSIS SYSTEM (DPMAS), TASK 1: REQUIREMENTS AND PLANS FOR PROTOTYPE EQUIPMENT. FINAL REPORT**

A prototype Driver Performance Measurement and Analysis System (DPMAS) is being tested. This report develops and summarizes the measurement and hardware requirements which specify the design and projected use of the system. The requirements evolve from consideration of several basic experimental areas, driver/vehicle/environment interaction studies, driver training and licensing, and research into abnormal driver behavior as induced by alcohol, drugs, fatigue, or unusual stress. Sensors, signal conditioners, and data acquisition and recording techniques and equipment to translate these requirements into reality are described. The emphasis is on standardized off the shelf, proven reliability equipment at the component level, and experimenter centered options and interfaces at the system level; The systems integration considers a variety of possible equipment subsets for the several potential purposes of DPMAS. These emphasize modular packaging and experimenter interface concepts to permit the

configuration of component subsets and ready transfer of the package or components thereof to a variety of other vehicles,

by D. T. McRuer; R. A. Peters; R. F. Ringland; R. W. Allen; A. A. Blauvelt; D. H. Weir  
Systems Technology, Inc., Hawthorne, Calif.  
Contract DOT-HS-359-3-733  
Rept. No. TR-1039-1 ; 1974 ; 159p 77refs  
Rept. for Jul-Dec 1973.  
Availability: NTIS

HS-801 235

**EFFECTS OF NOXIOUS GASES ON DRIVER PERFORMANCE. FINAL REPORT**

The nighttime driving performance of five healthy young drivers and five healthy aged drivers under the influence of carbon monoxide (12% carboxy-hemoglobin (COHb) level) was investigated. The young subjects were significantly affected in their visual search and control behavior, and in their physiological measures in terms of mean heart rate due to COHb effects. The visual search behavior of the aged subjects was affected differentially compared to the young at elevated COHb levels. Significant differences between subjects were age related but the combined age-COHb effects were rarely additive. The report also presents the results from driving tests, field sampling surveys to determine COHb levels of drivers, and sample oxides of nitrogen levels inside automobiles.

by T. H. Rockwell; R. L. Wick, Jr.; K. N. Balasubramanian  
Ohio State Univ., Columbus. Systems Res. Group  
Contract DOT-HS-115-3-772  
Rept. No. RF-3734 ; 1974 ; 169p 128refs  
Rept. for Jun 1973-Aug 1974. Prepared in cooperation with the Dept. of Preventive Medicine, Ohio State Univ.  
Availability: NTIS

HS-801 236

**UTILITY OF PROPERTY DAMAGE ACCIDENT DATA IN VEHICLE INJURY SOURCE ANALYSIS. FINAL REPORT**

The need for inclusion of property damage (PD) vehicle data in analyses designed to determine the influence of safety oriented component design modifications on occupant injury potential is examined. Vehicles included in the Tri-Level Accident Study files were classified as either pre-standards (not equipped with the safety components) or post-standards (equipped). Matched comparisons between these groups did not reveal an increase in the incidence of no occupant injury (indicates no increase in PD incidence) attributable to the safety modification. Examination of a sample of historical New York state accident data revealed little difference in PD accident reporting associated with vehicle component involvements. Previously obtained results (from injury producing accident data) relating thorax injury to the steering assembly were also examined to determine what characteristics noninjury data must have to support a hypothesis implied characteristics were sufficiently extreme that the inclusion on noninjury data would have been very unlikely to modify the original finding of no benefit associated with the energy absorbing

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device. It was concluded that PD vehicle data are not essential in injury source analysis.

by T. E. Anderson; K. Perchonok  
Calspan Corp., Buffalo, N. Y.  
Contract DOT-HS-053-3-619  
Rept. No. ZQ-5276-V-1R ; 1974 ; 58p 11refs  
Rept. for Jan-Dec 1973.  
Availability: NTIS

HS-801 237

### **EJECTION RISK IN AUTOMOBILE ACCIDENTS. FINAL REPORT**

The influence of various accident parameters on the probability of occupant ejection and the relative risk of occupant ejection along a variety of ejection routes were examined. The relation between injury severity and ejection route was also studied. Data pertaining to one and two car collisions involving American make automobiles manufactured between 1968 and 1973 were used in this study. The probability of occupant ejection was found to be related to type of collision. Vehicles involved in rollover collisions were demonstrated as more likely to produce occupant ejection than non-rollover vehicles. For non-rollover collisions, the door was recorded as the primary ejection route (door window ranked second). For rollover collisions, the door window, was demonstrated as the primary ejection route (door ranked second). Rear seated occupant were found to be the least likely to experience ejection. Ejection injury was demonstrated more severe than non-ejection injury, and ejection route was found to have no influence on expected injury severity. Because of the effectiveness of the lap belt-shoulder harness restraint system in reducing occupant ejection, it was concluded that increased restraint utilization could provide as effective a means of reducing ejection as vehicle redesigns.

by T. E. Anderson  
Calspan Corp., Buffalo, N. Y.  
CONTRACT DOT-HS-053-3-619  
Rept. No. ZQ-5276-V-2R ; 1974 ; 45p 6refs  
Rept. for Jan-Dec 1973.  
Availability: NTIS

HS-801 238

### **PASSENGER COMPARTMENT INTRUSION IN AUTOMOBILE ACCIDENTS. FINAL REPORT**

The influence of various accident parameters on the probability of passenger compartment intrusion and the relative ranking of intrusion sources (roof, door, etc.) in terms of frequency of occurrence were examined, as well as the injury hazard associated with compartment invasion. Data pertaining to one and two-car collisions involving American make automobiles manufactured between 1968 and 1973 were used. The incidence of passenger compartment intrusion (one inch and over) was found to average approximately 50% in non-rollover crashes and 97% in rollover crashes. The primary sources of intrusion recorded were the floor, dash panel, a-pillar and door (non-rollover collisions) and the roof, a-pillar and door (rollover) collisions. For non-rollover impacts, the incidence of intrusion was found to increase in accident severity. Vehicle size was demonstrated a less sensitive parameter; intrusion incidence rates for small and medium size vehicles were found to be similar, whereas large vehicle intrusion was calculated as

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less probable. Side impacts were demonstrated the most likely to produce compartment invasion. The door (non-rollover collisions) and roof (rollover collisions) were demonstrated as the primary injury sources. Minor intrusion (1-6 ins) did not appear to be associated with serious occupant injury.

by T. E. Anderson  
Calspan Corp., Buffalo, N. Y.  
CONTRACT DOT-HS-053-3-619  
Rept. No. ZQ-5276-V-3R ; 1974 ; 27p 5refs  
Rept. for Jan-Dec 1973.  
Availability: NTIS

HS-801 242

### **RECENTLY-PUBLISHED ANALYTICAL METHODS FOR DETERMINING ALCOHOL IN BODY MATERIALS. ALCOHOL COUNTERMEASURES LITERATURE**

Analytical methods for determining alcohol in body materials are reviewed. The report deals with analytical methods for alcohol in blood and other body fluids and tissues; breath alcohol methods; factors which may cause apparent or real errors in estimating blood alcohol concentration (BAC) from breath analysis; and proposed standards of accuracy for analytical methods which determine BAC by direct analysis of blood, or by estimation from breath analysis. Breath alcohol instruments and alcohol detector tubes are described in detail, pictures and/or schematic representations are included, and studies of the accuracy of the methods are given. Editorial opinions on possible deficiencies in experimental procedures or conclusions are sometimes included.

by R. N. Harger  
National Safety Council, Chicago, Ill. Com. on Alcohol and Drugs  
Contract DOT-HS-371-3-786  
1974 ; 98p 104refs  
Availability: Committee on Alcohol and Drugs, National Safety Council, 425 N. Mich. Ave., Chicago, Ill. 60611

HS-801 246

### **ALCOHOL/DRUG LITERATURE RELATED TO LAW ENFORCEMENT. FINAL REPORT. ALCOHOL COUNTERMEASURES LITERATURE REVIEW**

Various U. S. publications are reviewed in which a significant portion deals with legal matters or materials of direct bearing upon legislative policy, administration of justice, or law enforcement. Major reference works for the review period include the American Medical Association's "Alcohol and the Impaired Driver," a pocket supplement to Donigan's "Chemical Tests and the Law," and the 1973 supplement to Erwin's "Defense of Drunk Driving Cases, Criminal and Civil". The review deals with general policy recommendations developed by major writers, administration of justice including sanctions designed to deter the drinking driver, implications for law and law enforcement from Alcohol Safety Action Projects and related activities, roadside screening tests, implied



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consent laws, and legislation and legislative proposals at state and national levels.

by L. P. Watts  
National Safety Council, Chicago, Ill. Com. on Alcohol and  
Drugs  
Contract DOT-HS-371-3-786  
1974 ; 24p 54refs  
Availability: Committee on Alcohol and Drugs, National Safety  
Council, 425 N. Mich. Ave., Chicago, Ill. 60611

HS-801 261

#### **FRICTION OF POLYMERIC BRAKE MATERIALS. FINAL REPORT**

P. T. F. E. (Teflon) in brake material formulations produces a positive slope of coefficient of friction versus speed, on a Chase dynamometer. This sliding speed dependence is different from temperature dependence of friction. Teflon added to the brake formulation produces a more tenacious and even film on the metal counter surface with apparent rheopectic behavior.

by K. C. Ludema  
Michigan Univ., Ann Arbor  
Contract DOT-HS-031-3-675  
1974 ; 58p 3refs  
Rept. for 1 Aug 1973-31 Jul 1974.  
Availability: Michigan Univ. Regents, 240 Res. Administration,  
Ann Arbor, Mich. 48104

HS-801 266

#### **ALCOHOL EXPERIMENTS ON DRIVING-RELATED BEHAVIOR. A REVIEW OF THE 1972-1973 LITERATURE. ALCOHOL COUNTERMEASURES LITERATURE REVIEW**

Recent experiments concerned with influence of alcohol upon behavioral variables which are assumedly relevant for successful driving performance are examined. The review is limited to laboratory experiments (including part-task simulator studies) in which: alcohol was either the only drug or at least the primary drug investigated; healthy(non-alcoholic) subjects were used; and those aspects of behavior that seem more immediately involved in driving were investigated. Important trends are considered which have been developing and/or culminating in recent years, along with research needs suggested by recent reviewers, and a listing of recent investigation in which specialists rated priorities for basic research and applied research in the area of alcohol and highway safety.

by M. W. Perrine  
National Safety Council, Chicago, Ill. Com. on Alcohol and

#### **Drugs**

Contract DOT-HS-371-3-786  
1974 ; 78p 76refs

Prepared in cooperation with Univ. of Vermont Lab. for  
Alcohol and Drug Studies  
Availability: Committee on Alcohol and Drugs, National  
Safety Council, 425 N. Mich. Ave., Chicago, Ill. 60611  
HS-801 268

#### **COST AND RELIABILITY IMPACT OF AIR CUSHION DEPLOYMENT**

Air Cushion Restraint System Field Test data were found to be the most direct and reliable indication of system deployment frequency. Air cushion systems with the current sensor threshold have a deployment rate of .018 during 100,000 miles of passenger car life time exposure including only accidents with repairable damage. If all owners would restore deployed systems to operational status, the deployment rate with repairable cars time system replacement costs would amount to 3% of the initial consumer cost of the air cushion-lap belt system as delivered on a new vehicle. It was assumed that at least 40% of car owners would use their collision insurance coverage or otherwise be motivated to restore air cushion systems on reparable vehicles, and the effects upon cost and reliability were determined on this basis. It was noted that, independent of field test results, an analysis of the accident statistics infers that annual deployments could be as high as 710,000.

National Hwy. Traf. Safety Administration, Washington, D. C.  
1974 ; 11p 4refs  
Availability: Reference copy only

HS-801 271

#### **PROGRESS REPORT, OCTOBER 1974. (DEVELOPMENT OF ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUB-COMPACT CAR DRIVERS)**

Graphs and photographs illustrate the development sled test series and installation of the driver restraint system in the structurally modified Ford Pinto. Test results indicate completion of the program objectives: protection of the anthropometric size range from 5th percentile female to 95th percentile male in frontal and frontal oblique crashes at 50 and 45 mph, respectively. The results were obtained with the driver in substantially the same position in the compartment as he would be in the unmodified Ford Pinto.

Minicars, Inc., Goleta, Calif.  
Contract DOT-HS-113-3-742  
Rept. No. PR-Oct-74 ; 1974 ; 21p  
Availability: Minicars, Inc., 35 LA Patera Lane, Goleta, Calif.  
93017

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HIGHWAY ACCIDENT REPORT, GREYHOUND BUS/MALONE FREIGHT LINES, INC. TRUCK COLLISION--U. S. ROUTE 11W--BEAN STATION, TENNESSEE, MAY 13, 1972  
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PROGRESS REPORT, OCTOBER 1974. (DEVELOPMENT  
OF ADVANCED PASSIVE RESTRAINT SYSTEM FOR  
SUB-COMPACT CAR DRIVERS)

HS-801 271

**Minnesota Mining and Mfg. Co., St. Paul**  
ANALYTICAL INVESTIGATION OF THE PER-  
FORMANCE OF CATALYTIC MONOLITHS OF VARY-  
ING CHANNEL GEOMETRIES BASED ON MASS  
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HS-015 284

**Motor Vehicle Manufacturers Assoc., of the United  
States, Inc., Detroit Mich.**  
INSPECTION HANDBOOK FOR PASSENGER CARS,  
TRUCKS AND BUSES, MOTORCYCLES, SCHOOL  
BUSES, FOREIGN VEHICLES, THROUGH 1974  
MODELS WITH MANUFACTURER RECOMMENDA-  
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HS-015 361

**Motorcycle Safety Foundation, Inc., Washington, D. C.**  
THE BEGINNING RIDER COURSE FOR NOVICE MO-  
TORCYCLE RIDERS OF ALL AGES

HS-015 339

THE BEGINNING RIDER COURSE. STUDENT WORK-  
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HS-015 340

**Motorcycle Safety Foundation, Inc., Washington, D.C.**  
THE BEGINNING RIDER COURSE. INSTRUCTOR'S  
GUIDE

HS-015 341

**National Committee on Uniform Traffic Laws and  
Ordinances, Washington, D. C.**  
AGENDA FOR THE SUBCOMMITTEE ON SCOPE, JU-  
RISDICTION AND ENFORCEMENT

HS-015 315

AGENDA FOR THE SUBCOMMITTEE ON VEHICLES

HS-015 316

**National Hwy. Traf. Safety Administration, Washington,  
D. C.**  
EMERGENCY MEDICAL SERVICES: A BIBLIOG-  
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HS-801 179

COST AND RELIABILITY IMPACT OF AIR CUSHION  
DEPLOYMENT

HS-801 268

**National Res. Council of Canada, Ottawa, Ont.**  
EFFECT OF GROUND ON NEAR-HORIZONTAL  
SOUND PROPAGATION

HS-015 295

**National Safety Council, Chicago, Ill. Com. on Alcohol  
and Drugs**  
RECENTLY-PUBLISHED ANALYTICAL METHODS  
FOR DETERMINING ALCOHOL IN BODY MATERI-  
ALS. ALCOHOL COUNTERMEASURES LITERATURE

HS-801 242

ALCOHOL/DRUG LITERATURE RELATED TO LAW  
ENFORCEMENT. FINAL REPORT. ALCOHOL COUN-  
TERMEASURES LITERATURE REVIEW

HS-801 246

ALCOHOL EXPERIMENTS ON DRIVING-RELATED  
BEHAVIOR. A REVIEW OF THE 1972-1973 LITERA-  
TURE. ALCOHOL COUNTERMEASURES LITERA-  
TURE REVIEW

HS-801 266

**National Safety Council, Chicago, Ill.**  
CONSTITUTIONAL PROTECTIONS OF CONVICTED  
DWI OFFENDERS SELECTED TO RECEIVE SPECIAL  
SANCTIONS--ALCOHOL COUNTERMEASURES  
LITERATURE REVIEW. FINAL REPORT

HS-801 231

INTERNATIONAL CONFERENCE ON RESEARCH  
METHODOLOGY FOR ROADSIDE SURVEYS OF  
DRINKING-DRIVING-ALCOHOL COUNTERMEA-  
SURES WORKSHOP. FINAL REPORT

HS-801 220

THE NATURE OF BICYCLIST ACCIDENTS AND INJU-  
RIES

HS-015 358

**National Transp. Safety Board, Washington, D.C.**  
HIGHWAY ACCIDENT REPORT. AUTOMOBILE  
CRASH OFF THE SILLIMAN EVANS BRIDGE, I-24/65,  
NASHVILLE, TENNESSEE, JULY 27, 1973

HS-015 342

**National Transportation Safety Board, Washington, D. C.**

HIGHWAY ACCIDENT REPORT, GREYHOUND BUS/MALONE FREIGHT LINES, INC. TRUCK COLLISION--U. S. ROUTE 11W--BEAN STATION, TENNESSEE, MAY 13, 1972

HS-015 305

**Nippon Oil Seal Industry Co. Ltd., Fujisawa (Japan)**

A STUDY OF THE RELATION BETWEEN USED TEMPERATURE AND SEALING CHARACTERISTICS ON OIL SEALS

HS-015 287

**Nissan Motor Co. Ltd., Yokohama (Japan)**

ON CRASHWORTHINESS OF NISSAN ESV

HS-015 294

**North Carolina Univ., Chapel Hill. Highway Safety Research Center**

MOTORCYCLE ACCIDENTS: WHO, WHEN, WHERE, AND WHY

HS-015 299

**NOK-USA, Inc., Santa Ana, Calif.**

A STUDY OF THE RELATION BETWEEN USED TEMPERATURE AND SEALING CHARACTERISTICS ON OIL SEALS

HS-015 287

**Ohio State Univ., Columbus. Systems Res. Group**

EFFECTS OF NOXIOUS GASES ON DRIVER PERFORMANCE. FINAL REPORT

HS-801 235

**Ohio Univ., Athens, Dept. of Industrial and Systems Engineering**

DISTANCE JUDGMENT CAPABILITIES OF CHILDREN AND ADULTS IN A PEDESTRIAN SITUATION

HS-015 356

**Packer Engineering Associates, Inc., Naperville, Ill.**

THE EFFECT OF COMPOSITION AND MICROSTRUCTURE ON THE PITTING FATIGUE OF CARBURIZED STEEL CASES

HS-015 365

**Parker Seal Co., Culver City, Calif.**

HIGH TEMPERATURE SEALS, AUTOMOTIVE AND OTHER VEHICLES

HS-015 286

**Renault-Peugeot Assoc., La Garenne-Colombes (France)**

A CONTRIBUTION TOWARDS BETTER COMPATIBILITY BETWEEN VEHICLES

HS-015 359

**Ricardo and Co. Engineers Ltd., Dorchester, Dorset (England)**

A TECHNIQUE FOR ENDURANCE TESTING OF OXIDATION CATALYTIC REACTORS

HS-015 370

**Safety Management Inst., Washington, D. C.**

CONVERSION OF STATE ACCIDENT DATA TO UNIFORM ACCIDENT DATA TAPE FORMAT. STATE OF ALASKA. 1973 ACCIDENT YEAR

HS-015 385  
CONVERSION OF STATE ACCIDENT DATA TO UNIFORM ACCIDENT DATA TAPE FORMAT. STATE OF ALABAMA. 1972 ACCIDENT YEAR

HS-015 386

CONVERSION OF STATE ACCIDENT DATA TO UNIFORM ACCIDENT DATA TAPE FORMAT. STATE OF ARIZONA. 1973 ACCIDENT YEAR

HS-015 387

**Shell Chemical Co., Houston, Tex. Elastomers Technical Center**

HOT MELT BONDING WITH HIGH-STRENGTH THERMOPLASTIC RUBBER POLYMERS

HS-015 380

**Southwest Res. Inst., San Antonio, Tex.**

PUBLIC OPINION OF DIESEL ODOR

HS-015 297

**Systems Technology, Inc., Hawthorne, Calif.**

DRIVER PERFORMANCE MEASUREMENT AND ANALYSIS SYSTEM (DPMAS), TASK 1: REQUIREMENTS AND PLANS FOR PROTOTYPE EQUIPMENT. FINAL REPORT

HS-801 234

**SNAM Progetti, Milan (Italy)**

CHEMI-IONIZATION AND CARBON IN A SPARK IGNITION ENGINE

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**Timken Co., Canton, Ohio**

TRIANGULAR ASPERITIES CONTROL SEAL LEAKAGE AND LUBRICATION

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**Toyota Motor Co. Ltd., Kariya (Japan)**

TOYOTA ESV ENERGY MANAGEMENT SYSTEM AND WEIGHT ANALYSIS OF A SAFETY VEHICLE

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**Transport and Road Res., Lab., Crowthorne, Berks. (England)**

THE DEVELOPMENT OF THE GREEN CROSS CODE

HS-015 331

**Wayne State Univ., Detroit, Mich. Biomechanics Research Center**

HUMAN TOLERANCE TO IMPACT AND ITS APPLICATION TO SAFETY DESIGN

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**Wayne State Univ., Detroit, Mich.**

BIOMECHANICS OF THE SPINE AND PELVIS

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**Wayne State Univ., Detroit, Mich. School of Medicine**

BLUNT ABDOMINAL INJURIES: AN OVERVIEW

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HEAD INJURY

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**Westinghouse Electric Corp., Pittsburgh, Pa. Res. and Devel. Center**

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## **CONTRACTS AWARDED**

**DOT-HS-031-3-722 Mod. 5**

**ASAP BASELINE VOLUNTARY SURVEY**

The Regents of the University of Michigan  
260 Research Administration Building  
Ann Arbor, Mich. 48105

Extended through 31 Aug 75

Increased \$22,535.00

Roadside survey data for 1974 and 1975 is to be collected from the various Alcohol Safety Action Programs, and added to the master files in the archives. Special analytical studies utilizing the survey data will be prepared upon request from the National Highway Traffic Safety Administration or other qualified personnel, with the approval of the Contract Technical Manager.

**DOT-HS-031-3-765 Mod. 1**

**BRAKING EFFICIENCY TEST TECHNIQUE**

The Regents of the University of Michigan  
260 Research Administration Building  
Ann Arbor, Mich. 48105

Extended to 11 Nov 74

Increased \$6,500.00

Modifications which will isolate the hydraulic pump mounting from the fastenings of the load cell are to be made to the Surface Friction Dynamometer machine. The machine will be reassembled and a laboratory calibration be performed. Over-the-road trials of the modified machine will be conducted to demonstrate the quality of the normalized longitudinal force signal over a variety of load conditions. An appendix to the final report describing the performance characteristics of the machine will be furnished.

**DOT-HS-046-3-784 Mod. 4**

**LABORATORY TEST PROCEDURES**

Dynamic Science  
Division of Ultrasystems, Inc.  
1850 W. Pinnacle Peak Road  
Phoenix, Ariz. 85027

No change

\$95,000.00

Onboard high-speed cameras will film the motion of the driver, front passenger and center dummies in test vehicles in accordance with FMVSS Nos. 208, 212, and 301 dated 18 May 1973. Neon tape markers will be added to the left side of the front seats and to the

floorpan area in order to indicate that the front seats have been properly placed in the mid-position for the 50th percentile adult male dummies.

**DOT-HS-046-3-784 Mod. 5**

**LABORATORY TEST PROCEDURES**

Ultrasystems, Inc.  
Dynamic Science Division  
1850 W. Pinnacle Peak Road  
Phoenix, Ariz. 85027

No change

Increased \$57,750.00

Dummy calibrations required to perform FY '75 FMVSS 208 barrier impact tests will be made.

**DOT-HS-150-3-668 Mod. 3**

**EFFECT OF MARIJUANA AND ALCOHOL ON VISUAL SEARCH PERFORMANCE**

The Regents of the University of California  
University of California, Los Angeles  
405 Hilgard Avenue  
Los Angeles, Calif. 90024

1 July 74 through 30 June 75

Increased \$4,138.00

A fixed overhead rate of 34.2% is applied to total direct costs less expenditures for equipment; expenditures over \$50,000.00 for hospitalization and other expenses related to patient care; and expenditures for alterations and renovations.

**DOT-HS-225-2-385 Mod. 9**

**SAFETY TRAFFIC ENFORCEMENT PROGRAM (STEP)**

City of Tacoma  
Tacoma, Wash. 98402

To be completed 31 Dec 75

Increased \$28,935.00

The STEP grant award agreement dated 31 October 1972 as previously revised is further revised to incorporate Revision No. 2 dated 10 October 1974.

**DOT-HS-344-3-690 Mod. 3**

**DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES**

Rocket Research Corporation  
York Center  
Remond, Wash. 98052

No change

Increased \$22,918.00

Sled tests will be performed prior to a series of six (6) full scale vehicle tests using the air cushion re-

straint system developed under contract DOT-HS-113-2-441. Test matrix will consist of flat barrier impact, pole barrier impact and 30 degree oblique tests. Intermittent sled testing is anticipated during this task to investigate minor restraint problems encountered and the performance of the system under similar crash environments but different occupant loading conditions. Instrumentation is to include both photographic coverage and accelerometer transducers.

**DOT-HS-355-3-718 Mod. 3**

**CAUSATIVE FACTORS AND COUNTERMEASURES FOR RURAL PEDESTRIAN ACCIDENTS**

Biotechnology, Inc.  
3027 Rosemary Lane  
Falls Church, Va. 22042

To be completed thirty (30) months from date of contract modification

Increased \$159,828.00

Objectives of this research are to: determine and identify freeway pedestrian accidents and injury causation; and to develop and behaviorally evaluate countermeasures that will reduce freeway pedestrian accidents. To accomplish these objectives, the Contractor will review and evaluate selected pedestrian accident research and existing data. Should additional data be required the Contractor will provide it from available Federal, State, and local sources. A typology of freeway pedestrian accidents on the basis of causal similarity will be worked out and countermeasures for each of the causal accident types determined. The countermeasures should be designed to reduce or eliminate the predisposing factors that led to the precipitating event, reduce or eliminate the precipitating event directly, and reduce the injuries incurred. Data collected from evaluation of the countermeasures will be analyzed to indicate those found to be most effective in reducing freeway pedestrian accidents.

**DOT-HS-4-00802 Mod. 3**

**SAFETY HELMET PERFORMANCE INVESTIGATION**

Southwest Research Institute  
8500 Culebra Road  
San Antonio, Tex. 78284

Extended through 30 Nov 74

Increased \$22,000.00

The Contractor shall perform verification tests of headform prototypes, sizes "A", "B", "C", and "D".

**DOT-HS-4-00853 Mod. 3**

**HANDLING TEST PROCEDURES FOR LIGHT TRUCKS, VANS AND RECREATIONAL VEHICLES**

Dynamic Science  
Division of Ultrasystems, Inc.  
1850 W. Pinnacle Peak Road  
Phoenix, Ariz. 85027

To be completed four (4) months from date of modification

Increased \$13,550.00

A clear and concise documentation of the hybrid vehicle handling model for use in the vehicle handling field will be provided by the Contractor. Documentation shall include all assumptions used in the development of equations as well as limitations imposed by the model. Documentation is to include schematics, free body diagrams, relationships to general equations of motions, definitions of symbols and terms in the equations, descriptions of simplifying assumptions, and a discussion of the definitions of input parameters and means of measuring them.

**DOT-HS-4-00869 Mod. 3**

**LABOR HOUR CONTRACT FOR CODING, EDITING AND KEYPUNCH**

Opportunity Systems, Inc.  
1330 Massachusetts Avenue, N.W.  
Washington, D.C. 20005

Extended to 31 Dec 74

Increased \$9,427.20

The Coder/Editors' time is extended throughout 1974.

**DOT-HS-4-00872 Mod. 2**

**SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES**

Ultrasystems, Inc.  
Dynamic Science Division  
1850 W. Pinnacle Peak Road  
Phoenix, Ariz. 85027

No change

\$34,345.00

Effort and equipment necessary to acquire acceleration data for the vehicle(s) occupant compartment, frame, and firewall, during four (4) countermeasures demonstration tests, processing, and analyzing the data acquired will be provided by the Contractor. A series of four (4) baseline tests designed to duplicate the test environments and crash conditions of the countermeasures test series of the basic contract will also be performed.

**DOT-HS-4-00896 Mod. 1**

**UNIFORM TIRE QUALITY GRADING—TREADWEAR**

South Texas Tire Test Fleet, Inc.  
Drawer J  
Devine, Texas 78016

To be completed 31 Jan 75

Increased \$17,864.00

A 16,000-mile course was established with the 7.75-14 2/0 NHTSA control tire. This extension of contract will rate the 8.55-15 2/0 NHTSA control tire and the three (3) San Angelo course monitoring tires (bias, bias/belted, and radial) on this same 16,000-mile course where the 8.55-15 control tire will be worn to the 75% level. A related contract with the same group of tires will be run on the 400+6400 mile San Angelo treadwear course. Responses of these four (4) types of tires to these two different types of treadwear will be studied and, where pertinent, rated.

**DOT-HS-4-00905 Mod. 2**

**TIRE TREADWEAR TEST**

South Texas Tire Test Fleet  
Drawer J  
Devine, Texas 78016

No change

Increased \$2,916.11

An additional 10,452 vehicle test miles at \$0.2790 per vehicle mile will be run, increasing the total vehicle mileage from 138,600 to 199,052 miles.

**DOT-HS-4-00908 Amend. 3**

**TIRE TESTING FOR UNIFORM QUALITY GRADING SYSTEM**

Department of the Air Force  
HQ 6950th Air Group (USAFSS)  
Goodfellow Air Force Base, Tex. 76901

No change

\$7,000.00

Increased funds will provide for a thin (approximately two (2) inch) overlay of a special design of concrete mixture to the existing concrete surface. Polishing of replacement surface is required. Use of a special consultant is necessary to assure meeting desired surface specifications of texture in surface use of durable concrete, and lines and grades in keeping with specifications.

**DOT-HS-4-00921 Mod.1**

**QUANTIFICATION OF THORACIC RESPONSE AND INJURY**

The Regents of the University of Michigan  
260 Research Administration Building  
Ann Arbor, Mich. 48105

No change

Increased \$70,010.00

Additional funding provides for continued testing during FY '75.

**DOT-HS-4-00955 Mod. 1**

**EXPERIMENTAL FIELD TEST OF PROPOSED ANTI-DART-OUT TRAINING PROGRAMS**

Applied Science Associates, Inc.  
Box 158  
Valencia, Pa. 16059

To be completed 1 Feb 75

Increased \$120,702.00

Training materials, consisting of printed materials in various forms, street safety award patches, car mock-ups/barricades, films, simulators, and game materials will be produced and shipped to test site schools prior to inception of the February 1975 school terms.

**DOT-HS-4-00974 Mod. 1**

**SPECIAL ANALYSES ON PASSIVE RESTRAINT SYSTEMS AND EFFECTS OF ENERGY CRISIS**

Professor Herbert Solomon  
Statistics Department  
Stanford University  
Stanford, Calif. 94305

Extended to 30 Apr 75

Decreased \$4,000.00

That portion of the study involving the impact of the energy crisis on highway fatalities is deleted in its entirety.

**DOT-HS-4-00978 Mod. 1**

**RECREATIONAL VEHICLE SURVEY**

Pioneer Engineering & Manufacturing Co.  
2500 E. Nine Mile Road  
Warren, Mich. 48091

No change

Increased \$2,568.75

Five (5) Loadmeter Highway Scales will be acquired for use in the performance of the basic contract requirements.

**DOT-HS-5-01026 Mod. 1**

**TIRE TREADWEAR TEST-VARIABILITY AND NIGHT TESTING**

South Texas Tire Test Fleet, Inc.  
Drawer J  
Devine, Texas 78016

To be completed 31 Jan 75

Increased \$18,835.20

The Contractor shall provide and operate two convoys, each composed of four (4) vehicles, over a prescribed treadwear course established under contract DOT-HS-4-00905 and at the direction of the NHTSA/SRL Scientific Officer. The eight (8) vehicles, equipped with new tires, will be run a total of 57,600 miles. Tires will be rotated and tread groove measured after each 800 miles. Wet miles and mileage on any tire which fails will be recorded.

**DOT-HS-5-01026 Mod. 2**

**TIRE TREADWEAR TEST-VARIABILITY AND NIGHT TESTING**

South Texas Tire Test Fleet, Inc.  
Drawer J  
Devine, Texas 78016

To be completed 31 Jan 75

Increased \$82,731.00

The test shall constitute three (3) convoys—a five (5) car convoy for bias ply tires, a three (3) car convoy for bias belted tires, and a three (3) car convoy for radial tires. All tires shall undergo a break-in period of 800 miles with specified rotation at 400 miles, and again at 800 miles during the actual road test. All cars to be used are to be identical and tread groove is to be measured at six equally spaced points in each groove.

**DOT-HS-5-01027 Mod. 2**

**CONTROL TIRE MOLD. CONTROL TIRES**

The Armstrong Rubber Company  
500 Sargent Drive  
New Haven, Conn. 06507

No change

Increased \$6,498.00

The number of control tires, 7.75-14, to be manufactured is increased from 50 each to 100 each, an increase of 50 tires.

**DOT-HS-5-01029 Mod. 1**

**TIRE TRACTION SURFACE MONITORING**

Transportation Research Center of Ohio  
East Liberty, Ohio 43319

No change

Increased \$2,809.21

Test time will be increased by three (3) hours on five (5) days and by 8½ hours on one (1) day. Use of the trailer and a three (3) man crew is included.

**DOT-HS-5-01036**

**DIAGNOSTIC MOTOR VEHICLE INSPECTION DEMONSTRATION PROJECTS PROGRAM EVALUATION SUPPORT**

Computer Sciences Corporation  
Systems Division  
6565 Arlington Boulevard  
Falls Church, Va. 22046

To be completed thirty (30) months from date of contract award

\$711,969.00

Diagnostic Inspection Demonstration Projects are designed to provide information and data to determine the relative costs and benefits of such projects in order to determine whether a diagnostic inspection program would be cost effective. The Contractor will assist the National Highway Traffic Safety Administration (NHTSA) in collecting this information and data; in performing a program evaluation; and in preparing a cost-benefit analysis of the program. Evaluations will involve administrative costs, diagnostic center operational costs, cost to the individual motorist, and accrued advantages to the public including safer vehicles and reduced accidents; reduced emissions, aggregate repair, maintenance, and fuel cost savings; and higher resale or longer vehicle life. In the performance of the cost-benefit analysis the Contractor shall review data generated by the State diagnostic demonstration projects, other published studies, information and data relevant to the program. The analysis will identify and assess the tangible and intangible socio-economic benefits as well as the direct and indirect costs. A prospective assessment shall be made of the likely costs and benefits of alternative strategies for the future as compared with the present program.

**DOT-HS-5-01037**

**DIAGNOSTIC MOTOR VEHICLE INSPECTION DEMONSTRATION PROJECTS PROGRAM ENGINEERING SUPPORT**

AVCO Systems Division  
201 Lowell Street  
Wilmington, Mass. 01887

To be completed 30 Nov 76

\$808,304.00

Would a diagnostic inspection program be cost effective in the sense that public benefits would exceed program costs? Would a program of this kind provide the consumer with specific technical diagnoses to facilitate repair of failed vehicle components? With these goals in view, raw data will be provided by State inspection models utilizing engineering techniques. The Contractor will analyze, interpret, monitor, and evaluate the more generalized tasks performed by State diagnostic inspection demonstration projects, and the vehicle inspection data which results, in order to make recommendations as to how future diagnostic testing equipment might be improved to alleviate the problems noted, and to enhance interchangeability and interface capability of test equipment and vehicles.

**DOT-HS-5-01039**

**SAFETY BELT INTERLOCK SYSTEM USAGE SURVEY**

Opinion Research Corporation  
North Harrison Street  
Princeton, N.J. 08540

To be completed 31 Dec 75

\$99,635.00

Objective is to monitor the usage rate of safety belts by drivers and front seat passengers in 1973, 1974 and 1975 model cars. Nineteen (19) cities which are representative of the United States from geographical, weather, and population viewpoints, and located at strategic intersections, will be selected. Observers, trained to identify the model cars, will record pertinent data as to belt usage, sex of those observed, make of car, seat type, number of occupants, year of car, and license tag number. Data will be analyzed to: compare usage rates as a function of model year, use-inducing system and related variables; determine the extent played by the factors influencing belt usage and reactions to various use-inducing systems; and assess differences between manufacturers/systems regarding usage, comfort and convenience, acceptance and reliability.

**DOT-H-5-01040**

**TESTING PROCEDURE FOR SPLASH AND SPRAY**

Southwest Research Institute  
8500 Culebra Road  
San Antonio, Texas 78228

To be completed 15 Oct 74

\$16,350.00

The overall objective of this project is to evaluate a test procedure for measuring splash and spray created by trucks when exceeding the speed of fifty (50) miles per hour in inclement weather. A conventional 6 x 4 truck-trailer pulling a 40 ft. van semitrailer, with spray protectors will be used. Photographic data for a densitometer analysis will be made from the side of the vehicle as it passes through the test course to determine the relative amount of spray created by various vehicles. An analysis of the data will include the percentage amount that each type of protector reduces the spray from the standard base vehicle without any protector.

**DOT-HS-5-01041**

**A MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT**

State of Tennessee  
Nashville, Tenn. 37219

To be completed twenty-one (21) months from date of contract award

\$3,524,182.00

The goal of the Motor Vehicle Inspection Program under the Highway Safety Act of 1966 is to reduce, through improved State inspection programs, the percentage of accidents caused by or contributed to by vehicle degradation and defects. Diagnostic inspection demonstration projects, utilizing applied engineering techniques, will provide the consumer with specific technical diagnoses to facilitate the repair of failed components. State experience of applying diagnostic inspection techniques is expected to provide cost data and experience for improving present State vehicle inspection programs in the areas of data evaluation and engineering. The goal of evaluation of these programs is to determine if a national diagnostic inspection program would be cost effective in the sense that the public benefits should exceed the program costs.



**DOT-HS-5-01043****STATEWIDE HIGHWAY SAFETY PROGRAM ASSESSMENT**

Small Business Administration  
1 Decker Square  
Bala-Cynwyd, Pa. 19004

To be completed 9 May 75

\$120,000.00

Through development of data collection instruments, supporting documents, and collection procedures, for both a one State pilot test and subsequent data collection in nine (9) sample States, the Contractor shall identify and assess statewide highway safety systems and progress in major categories of program activity over the most recent three (3) to five (5) years. Determination is to be made as to what guidance and impetus the Federal 402 Grant Program provided in these statewide highway safety trends; to assess the variation of impact of environmental, demographic and economic trends upon State program planning; and to help ascertain what impact State programs and Federal planning have had on highway accident and fatality reduction.

**DOT-HS-5-01044****UPDATING THE VEHICLE SELECTION MATRIX**

Kappa Systems, Inc.  
1501 Wilson Boulevard  
Arlington, Va. 22209

To be completed fifteen (15) months from date of contract award

\$16,927.00

Data from Vehicle Compliance Test Files, Vehicle Multidisciplinary Accident Files (MDAI), Vehicle Owner Complaint Files, and Supplementary Data Sheets is to be retrieved, analyzed, and machine prepared for inclusion into the Vehicle Selection Matrix. Files are to be updated with applicable data once each quarter.

**DOT-HS-5-01045****DATA CONVERSION SERVICES FOR NATIONAL DRIVER REGISTER**

Informatics, Inc.—IPS  
6425 Landover Road  
Cheverly, Md. 20785

To be completed 30 Sept 75

\$83,136.00

Conversion of hard copy source documents to magnetic tape for the National Driver Register (NDR)

is to be made on an estimated total of 1,600,000 records. Source documents to be converted are in various formats and contain differing data elements. A hard copy in the form of a tape print, punch cards or optical character recognition (OCR) listings will be furnished to the National Highway Traffic Safety Administration (NHTSA) in addition to the magnetic tape.

**DOT-HS-5-01047****UNIFORM TIRE QUALITY-TREADWEAR**

Compliance Testing, Inc.  
1140 N. Freedom Road  
P.O. Box 351  
Ravenna, Ohio 44266

To be completed one hundred twenty (120) days from date of contract award

\$27,956.50

A proposed treadwear rating procedure estimated to require as little as 800 gallons of gasoline consumption will be tested to compare results with current Uniform Tire Quality Grading (UTQG) procedure. While this proposed procedure does not offer a major reduction in vehicle/hours, possibly a 20% saving over the current UTQG method, there is a 50% saving in gasoline consumption. A treadwear program where control and commercial tires are compared on a standard "Country Type" course vs. a "City Type" test route is to be followed. The "Country" route will follow UTQG procedure while the "City" route will contain features compatible with the new proposal. Treadwear ratings will be obtained on F78-14 bias, bias belted and radial commercial tires using the 7.75-14 (2 ply) National Highway Traffic Safety Administration (NHTSA) control tires as the reference base.

**DOT-HS-5-01048****REPORT TO CONGRESS ON ADMINISTRATIVE ADJUDICATION**

American Bar Association Foundation for Public Education on Behalf of Center for Administrative Justice  
1785 Massachusetts Ave., N.W.  
Washington, D.C. 20036

To be completed 1 Apr 75

\$23,405.00

The Contractor shall conduct an independent survey of the administrative adjudication of traffic infractions

to assist the National Highway Traffic Safety Administration (NHTSA) in preparing a report to Congress on it. He shall provide technical advice and assistance to NHTSA on preparation of a report to Congress on administrative adjudication of traffic infractions, and evaluate this report for technical soundness, completeness and style, and recommended appropriate changes and revision.

**DOT-HS-5-01055**

**A MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT**

Commonwealth of Puerto Rico  
San Juan, P. R. 00901

To be completed twenty-three (23) months from date of contract award

\$3,007,625.00

All phases of development for establishment and operation of a Motor Vehicle Diagnostic Inspection Demonstration Project are to be implemented in accordance with the Motor Vehicle Information and Cost Savings Act, PL 92-513. State experience of applying diagnostic inspection techniques is expected to provide cost data and experience for improving present State vehicle inspection programs in the areas of data evaluation and engineering. The goal of evaluation in these programs is to determine if a national diagnostic inspection program would be cost effective in the sense that the public benefits should exceed the program costs.

**DOT-HS-5-01056**

**A MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT**

State of Alabama  
Montgomery, Ala. 36104

To be completed twenty-one (21) months from date of contract award

\$3,055,833.00

The goal of the Motor Vehicle Inspection Program under the Highway Safety Act of 1966 is to reduce, through improved State inspection programs, the percentage of accidents caused by or contributed to by vehicle degradation and defects. Diagnostic inspection demonstration projects, utilizing applied engineering techniques, will provide the consumer with specific technical diagnoses to facilitate the repair of failed

components. State experience of applying diagnostic inspection techniques is expected to provide cost data and experience for improving present State vehicle inspection programs in the areas of data evaluation and engineering. The goal of evaluation of these programs is to determine if a national diagnostic inspection program would be cost effective in the sense that the public benefits should exceed the program costs.

**DOT-HS-5-01057**

**A MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECT**

State of Arizona  
Phoenix, Ariz. 85007

To be completed twenty (20) months from date of contract award

\$2,969,368.00

The goal of the Motor Vehicle Inspection Program under the Highway Safety Act of 1966 is to reduce, through improved State inspection programs, the percentage of accidents caused by or contributed to by vehicle degradation and defects. Diagnostic inspection demonstration projects, utilizing applied engineering techniques, will provide the consumer with specific technical diagnoses to facilitate the repair of failed components. State experience of applying diagnostic inspection techniques is expected to provide cost data and experience for improving present State vehicle inspection programs in the areas of data evaluation and engineering. The goal of evaluation of these programs is to determine if a national diagnostic inspection program would be cost effective in the sense that the public benefits should exceed the program costs.

**DOT-HS-5-01059**

**ADMINISTRATIVE LOGISTICS AND TECHNICAL SUPPORT FOR THE 4TH INTERNATIONAL CONGRESS ON AUTO SAFETY**

Ultrasystems, Inc.  
Dynamic Science Division  
1850 W. Pinnacle Peak Road  
Phoenix, Ariz. 95027

To be completed 18 Aug 75

\$24,900.00

The National Motor Vehicle Safety Advisory Council (NMVSAC) is planning to host the Fourth (4th)

International Congress on Automobile Safety in San Francisco, July 1975. The National Highway Traffic Safety Administration (NHTSA) will provide the resources necessary for the technical and administrative support of the Congress. Overall plans and preparations for the Congress' activities will be developed and coordinated by the Contractor, a technical evaluation and review of all materials presented will be made, and an administrative report delivered to NHTSA following completion of the Congress.

**DOT-HS-5-01062**

**STATES' MODEL MOTORIST DATA BASE**

American Association of Motor Vehicle Administrators  
1201 Connecticut Avenue, N.W.  
Suite 910  
Washington, D.C. 20036

To be completed 7 Nov 75

\$53,160.00

State, private and Federal committee members actively involved in the work of the American National Standards Institute Committee D-20 believe that a States' Model Motorist Data Base, established as a standard through the consensus of the American National Standards Institute (ANSI), will speed the adoption and implementation of data standards on a wide-scale basis. The American Association of Motor Vehicle Administrators (AAMVA) acts as the coordinating organization through which the State motor vehicle data processing systems can be brought together as a national network designed to meet the traffic safety data interchange needs of the private sector, the Federal Government, and the States. As Contractor the AAMVA is to produce a document containing the ANSI D-20 "States' Model Motorist Data Base" draft standards and to disseminate these draft standards to members of the highway safety profession and other interested parties through the AAMVA sponsored ANSI D-20 committee membership for consensus approval.

**DOT-HS-5-01067**

**LABORATORY TEST PROCEDURE FOR TESTING OF MOTOR VEHICLES FOR CONFORMANCE TO FEDERAL MOTOR VEHICLE SAFETY STANDARD (FMVSS) NO. 121-AIR BRAKE SYSTEM**

Automotive Research Associates, Inc.  
5404-08 Bandera Road  
San Antonio, Texas 78238

To be completed 15 Apr 75

\$76,096.00

Contractor will provide a Laboratory Test Procedure for testing to FMVSS 121-Air Brake Systems, which will furnish adequate uniform guidance to agents of the Government in: the preparation of equipment and samples for standards enforcement tests and performance of standards enforcement tests and determination of pass or fail; and the reporting of results of standards enforcement tests. Validity of the methods and means described in the laboratory test procedure by the performance of tests or portions of tests of samples, utilizing those methods and means in the preparation for, the performance of, and the reporting of, the results of those tests, will be furnished.

**DOT-HS-5-01068**

**UNIFORM TIRE QUALITY GRADING TREADWEAR COURSE MONITORING**

Southwest Research Institute  
8500 Culebra Road  
San Antonio, Texas 78284

To be completed twelve (12) months from date of contract award

\$66,700.00

Thirty-six (36) complete Treadwear Course Monitoring Tests, each consisting of one (1) 400 mile break-in loop and sixteen (16) 400 mile treadwear loops, will be made. Monitoring is for the purpose of confirming that the established course has not changed from its established wear rate, or if it has changed, to verify that. Standard vehicles will be driven in the thirty-six (36) tests to be run during the twelve (12) month period of the contract.

U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

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